Storage Devices

Training Module

PowerComputing™

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Hardware Setup

Introduction

When something goes wrong with a computer, storage devices are frequently involved. Disk drives are the components of a computer that contain moving parts, and are therefore the most prone to failure. Additionally, the writeable nature of most storage devices makes the information they contain susceptable to corruption. Because of this, all service technicians should have a thorough knowledge of the storage devices used in the computer and how to isolate problems involving them.

This training module covers the types of storage devices used in Power Computing equipment, how they are configured, and how to troubleshoot problems with them.

Types of Storage Devices

Power Computing offers a wide range of storage devices for its computers. Some of them are standard equipment on all models, and others are available as options.

Floppy Disk. A floppy disk drive is standard equipment on all Power Computing computers. The 3 1/2-inch disks hold 1.44 Mb of data. The drive is the same self-ejecting mechanism used on Apple Macintosh computers.

Fixed Disk. Hard disk drives are standard on all Power Computing models, in capacaties from 500 Mb to 4 Gb.

Removeable Disk. Removeable disks drives are mechanisms designed so the storage medium may be taken out of the drive for safekeeping and transportation. Iomega® Zip™ (100 Mb) and Jaz™ (1 Gb) drives are optional equpment on some Power Computing models.

CD-ROM. CD-ROM drives were optional on Power Computing's early models, and are now standard equipment. Drive speeds range from 4x to 16x.

RAID. Some applications, such as digital video, require high-performance storge devices. To meet this need, a Redundant Array of Inexpensive Disks (RAID) is available as an option for the PowerTower Pro™.

Busses

All storage devices communicate with the rest of the computer through a specialized data pathway called a bus. With the exception of the floppy drive, Power Computing uses one of two types of busses for its storage devices.

Enhanced Intelligent Device Electronics (EIDE)

EIDE is a moderate-performance, low-cost bus that is widely used in IBM-compatible computers. EIDE is a 16-bit bus that can address hard drives as large as 8.4 Gb, and is also known by the name Advanced Technology Interface (ATA). Apple® has recently begun using EIDE devices in its Performa™ and PowerBook™ products. Power Computing uses EIDE hard drives as standard equipment in its PowerBase model. EIDE devices share bus control duties with circuits on a card, or on the main logic board in the case of the PowerBase™, and can be set to either a master or slave configuration. The master device controls the signals passing to the slave devices. The hard drive in the PowerBase is set to master. The PowerBase is designed to use a single EIDE device; the CD-ROM drive and any removable drives in the PowerBase are connected to a separate SCSI bus.

Small Computer System Interface (SCSI)

SCSI is a widely used method of connecting storage devices within a computer and peripheral devices outside of a computer. It provides a relatively high speed connection, and allows multiple devices to be connected together in a chain. Most Macintosh® computers and all Power Computing models use SCSI devices. SCSI is used on IBM-compatible computers when high-performance storage devices are required.

SCSI is a standard specification that has been developed and expanded to meet a range of needs. Power Computing uses several different forms of SCSI busses.

Standard SCSI. This is the most common form of SCSI bus, widely used for moderate speed devices like some internal hard drives, CD-ROM drives and removable disk drives. It is also used to connect external devices such as hard drives and scanners. Standard SCSI transfers 8 bits at a "normal" rate and supports a data transfer rate of 5 Mb/sec on a 50-pin internal or 25-pin external cable.

Fast SCSI. This is a higher speed SCSI bus used to connect high-performance hard drives. Some computers, like the PowerWave™ and PowerTower Pro, have a Fast SCSI bus for connecting internal storage devices. Fast SCSI transfers 8 bits at an accelerated rate and supports data transfer rates of 10 Mb/sec on a 50-pin internal cable.

Wide SCSI. This is also a high speed SCSI bus for high performance hard drives. Wide SCSI transfers 16 bits at a normal rate and supports data transfer rates of 10 Mb/sec on a 68-pin cable.

Ultra SCSI. Ultra SCSI is a protocol for sending data at a greatly accelerated rate. This protocol is used with both narrow (8-bit) and wide (16-bit) devices to achieve data transfer rates of 20 Mb/sec. and 40 Mb/sec., respectively.

Power Computing implements SCSI on its computers in several different fashions. SCSI busses are controlled by special-purpose circuits that coordinate communication between devices and with the computer. Some computers, such as the PowerCenter™, have SCSI controllers on the main logic board that operate one SCSI bus for both internal and external devices. These models can have a total of seven SCSI devices. Other computers, such as the PowerTower Pro, have SCSI controllers on the main logic board that are designed to handle two SCSI busses simultaneously, one for internal devices and one for external devices. These computer can handle a total of 14 devices. In some situations, additional SCSI controllers are added to the computer in the form of a card plugged into one of the PCI expansion slots. Power Computing uses a PCI card manufactured by Adaptec® to control the hard drive in the PowerCenter Pro™ and RAID configurations in the PowerTower Pro.

The following table summarizes the bus configurations of Power Computing computers.

Power Computing bus configurations

	Power 100/120	PowerWave	PowerCurve/Center/ Tower	PowerTower Pro	PowerBase	PowerCenter Pro
IDE	—	—	—	—	INT	—
SCSI	EXT	EXT	INT/ EXT	EXT	INT/ EXT	INT/ EXT
Fast SCSI	INT	INT	—	INT	—	—
Ultra/ Narrow SCSI	—	—	—	—	—	Adaptec (hard drive)
Ultra/ Wide SCSI	—	—	—	Adaptec (RAID)	—	—
INT=Internal		EXT=External				

Multiple SCSI devices are used with one computer by linking them together along the bus. Internal devices are connected to a single cable, and external devices are connected to one another in series with several lengths of cable.

There are specific rules of usage that must be followed when connecting SCSI devices inside or outside the computer. Failure to follow these rules may result in loss of data or failure of the computer to boot properly.

ID numbers. Each SCSI device is identified to the computer by an ID number. Each device on a SCSI chain must have its own unique ID number in the range of 0 through 6. ID 7 is reserved for the main logic board. Computers with separate internal and external SCSI busses use the ID numbers 0 through 6 on each bus. ID numbers are determined by switches or jumpers on each device. The following table lists the ID numbers of SCSI devices installed by Power Computing.

Common SCSI device ID numbers

0	hard drive
1	secondary hard drive
2	Jaz
3	CD-ROM
4	—
5	Zip
6	—

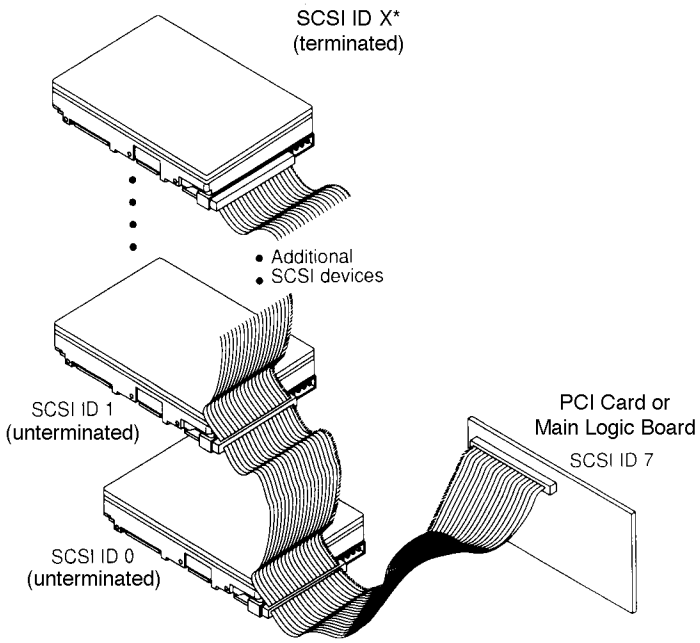
Termination. Each SCSI bus must be terminated at both ends. Termination applies electrical resistance to the end of the chain, preventing signals from reflecting on the cable and corrupting passing data. Cable attachments to the main logic board and PCI controller card are terminated. The device connected to the other end of the internal SCSI cable must have termination turned on. Similarly, the last device in an external chain must be terminated. Devices are terminated in one of several methods: switches, jumpers, terminator plugs, or auto-sensing circuitry. Long external SCSI chains may require the use of a powered terminator to boost the signals passing through the cable.

Power. All external SCSI devices must be turned on before the computer is turned on, and turned off after the computer is turned off. Internal SCSI devices are automatically turned on and off by the computer.

Cables. Cables should be as short as possible. The maximum length allowed is 6 ft. for any individual cable, and 20 ft. for the entire chain. Limit cable lengths to 1.5–2 ft., when possible. Cables *inside* each device need to be included in the total length; allow two feet per device. Internal SCSI cables are installed by Power Computing. External SCSI cables are supplied by the user, and should be of double-shielded, twisted-pair construction.

The illustration below shows several internal devices linked together in a chain.

Example of an internal SCSI chain



Configuration

Floppy disk drive

No configuration of the floppy drive is necessary. Simply install the drive into the chassis according to the instructions in the appropriate Certification Module.

Hard disk drive

EIDE. EIDE hard drives are configured by Power Computing. Install the drive into the chassis according to the instructions in the appropriate Certification Module.

SCSI. SCSI hard drives must have their ID and termination jumpers set prior to installation. Primay hard drives should be set to ID 0, and secondary hard drives should be set to ID 1. Check the hard drive's position on the SCSI cable. If it is at the end of the SCSI cable, set termination to on. If the hard drive is connected to the middle of the SCSI cable, turn termination off.

Iomega Jaz and Zip drives

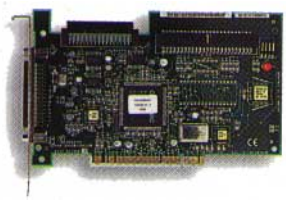
Jaz and Zip drives must have ID jumpers set prior to installation. Set Jaz drives to ID 2 and Zip drives to ID 5. Zip drives must have termination jumpers set to the off position. Jaz drives have no means of termination.

CD-ROM drive

CD-ROM drives must have ID and termination jumpers set prior to installation. Set the drive to ID 3. Check the CD-ROM drive's position on the SCSI cable. If it is at the end of the SCSI cable, set termination to on. If the hard drive is connected to the middle of the SCSI cable, turn termination off.

Adaptec PCI cards

Model 2930BMAC™. The Adaptec 2930 PCI card provides the Ultra/Narrow SCSI bus for the hard drive in the PowerCenter Pro. Install the card according to the instructions in the *PowerCenter Pro Certification Module*.This SCSI card will support one hard drive in the Low Profile chassis and two drives in the Mini-Tower chassis. The card has a connector for external devices, but its use is unsupported by Power Computing. The Adaptec 2930 card uses the BoardControl™ software to control its operation. Set the ID number of the drive at the end of the Ultra SCSI cable to 0, and the termination to the on position. If a second hard drive is installed in the Mini-Tower chassis, set the ID to 1 and the termination to the off position.



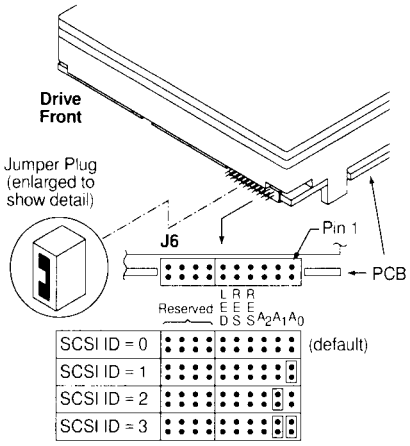
Model 2940UW™. The Adaptec 2940 PCI card provides the Ultra/Wide SCSI bus for RAID configurations in the PowerTower Pro, and the Ultra/Narrow SCSI bus for the hard drive in some PowerCenter Pro computers. Install the card according to the instructions in the approprate certification module.This SCSI card will support one hard drive in the PowerCenter Pro Low Profile chassis and two drives in the PowerCenter Pro Mini-Tower chassis and the PowerTower Pro RAID configuration. The card has a connector for external devices, but its use is unsupported by Power Computing. The Adaptec 2940 card uses the PowerDomain Control™ software to control its operation. Set the ID number of the drive at the end of the Ultra SCSI cable to 0, and termination to the on position. If a second hard drive is

installed, set its ID to 1 and termination to the off position.

Jumper positions

SCSI ID and jumper positions vary from device to device. Refer to *SCSI ID and Termination Settings* or the Power Source database for information on how to set jumpers for a specific drive mechanism.

Example of SCSI hard drive ID jumpers



Audio/Video Performance

Mac OS systems have opened the door to affordable digital audio and video (A/V) editing. These applications are very demanding not only of the computer's processing power, but of its storage systems as well. The large file sizes and high data rates involved in A/V work impose special requirements on hard drives used for this purpose. Hard drive manufacturers have responded to these needs by releasing hard drives optimized for A/V use. Micropolis was one of the first companies to sell hard drives sold expressly for A/V use, and have trademarked the designation "AV." Subsequently, other manufacturers refer to their products as "A/V rated" or "A/V capable." There are two main factors that make a hard drive suitable for A/V use.

Data transfer rates. A/V recording produces a continuous data stream of 3.5 Mb/sec. or more. A hard drive must be capable of maintaining this volume for the entire duration of the recorded segment. Traditional hard drives are capable of transferring a large initial burst of data, but not a continuous stream. Therefore, a drive's sustained data transfer rate is more critical than the maximum data transfer rate that is usually advertised.

Thermal recalibration. All hard drives depend on some means of self-adjustment to match current operating conditions. Hard drives are built to operate within tolerances of millionths of an inch. Because of these narrow requirements, drives must compensate for the natural expansion and contraction of materials due to changing temperatures. No transfers can occur during this adjustment, so data is held in a buffer until the drive is available again. Traditional hard drives perform this adjusment on a regular interval. With most applications, this is not perceptible to users. Because of the streaming nature of A/V data, information that passes the drive during this recalibration is lost. As a result, the recorded segment will appear jerky or choppy. Hard drives made for A/V work perform all thermal calibration before and after read/write operations so data transfers may continue uninterrupted.

Power Computing makes A/V rated hard drives available in most systems. All 7200 RPM hard drives sold by Power Computing have been selected. for their A/V capabilities. These drives include the Micropolis AV, Seagate Barracuda, and Western Digital Enterprise models. Some 5400 RPM drives, such as the IBM Capricorn, will also perform well for some A/V applications. Consult the Power Source database for specifications and capabilities of specific hard drive models.

Software Tools

Power Computing supplies several software tools for operating and maintaining storage devices. Some of this software is used only for the initial setup of a device, while others may be required for its operation.

Some software for setup and maintenance of the hard drive may require the computer to be booted from the CD-ROM drive. There are two ways to accomplish this.

To boot from CD-ROM via the keyboard:
- Place the Power CD in the CD-ROM drive.
- Start or restart the computer.
- Before the gray screen appears, hold down **Command (⌘), Option, Shift,** and **Delete**. Release the keys when the Happy Mac or Welcome to Macintosh screens appear.
- Check to see if the hard drive mounts on the desktop after the Finder loads. If it does not, mount the drive with Hard Disk ToolKit™ or Drive Setup™, as described below.
- To boot the computer from the hard drive again, simply restart the computer.

To boot from CD-ROM via the System software:
- Place the Power CD in the CD-ROM drive.
- Open the **Startup Disk** control panel.

Startup Disk Control Panel

- Click once on the Power CD icon to designate the CD-ROM as the startup drive. Close the control panel.
- Restart the computer.
- To boot the computer from the hard drive again, open the **Startup Disk** control panel, select the hard drive, and restart the computer.

Always confirm that the computer has booted from the Power CD as intended. Look at the positions of the disk icons after the Finder has drawn the desktop. The boot disk will always appear in the upper right corner of the desktop. The Power CD should be the topmost icon, as pictured below.

Power CD as the startup disk

Hard Disk ToolKit

FWB® incorporated

FWB®'s Hard Disk ToolKit is the primary software tool used to work with SCSI hard drives in Power Computing computers. This software is used to:

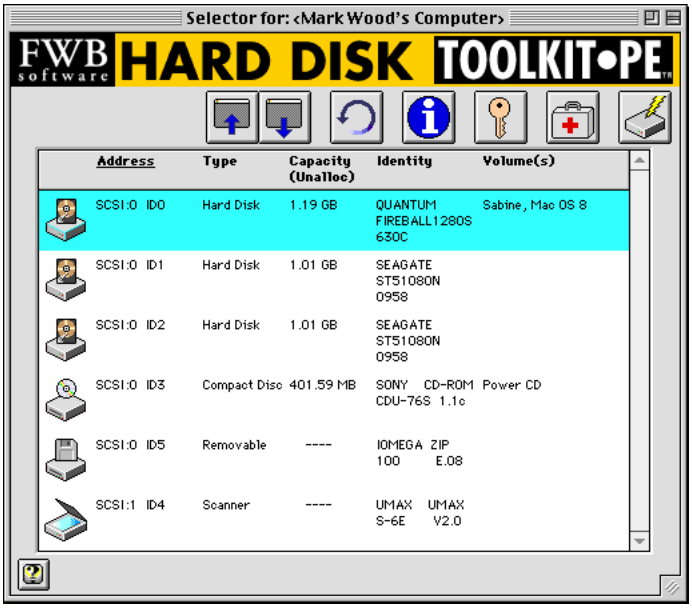
- Format new and replacement hard drives
- Create, modify, and delete partitions
- Mount and unmount volumes
- Test drives for defects

The version of Hard Disk Toolkit distributed by Power Computing is the Personal Edition, FWB's OEM version. Power Computing customers may purchase an upgrade to the full commercial package directly from FWB.

Hard Disk ToolKit cannot operate on the drive from which it is running. The most convenient way to use Hard Disk ToolKit is to boot the computer from the Power CD before launching the software.

Note: Hard Disk ToolKit underwent substantial interface changes in the revision to version 2.X. The name also changed from HDT Primer PE™ to Hard Disk ToolKit PE™. Although the locations have changed, most commands have remained the same. The examples given below are for version 2.X; important notes for users of version 1.7.7 and earlier are provided at the end of each of the following sections.

Hard Disk ToolKit main window


Selector for: <Mark Wood's Computer>
FWB software
HARD DISK TOOLKIT•PE
Address
Type
Capacity (Unalloc)
Identity
Volume(s)
SCSI:0 ID0 Hard Disk 1.19 GB QUANTUM FIREBALL1280S 630C Sabine, Mac OS 8
SCSI:0 ID1 Hard Disk 1.01 GB SEAGATE ST51080N 0958
SCSI:0 ID2 Hard Disk 1.01 GB SEAGATE ST51080N 0958
SCSI:0 ID3 Compact Disc 401.59 MB SONY CD-ROM Power CD CDU-76S 1.1c
SCSI:0 ID5 Removable ---- IOMEGA ZIP 100 E.08
SCSI:1 ID4 Scanner ---- UMAX UMAX S-6E V2.0

Hard Disk ToolKit lists all SCSI devices in its main window, along with important information about each device. Buttons for performing common tasks are available in this window, as well. *(**1.X**: Version 1.X lists only the internal or external bus in the main window at one time. Switch between them by selecting them from the* **SCSI Bus** *menu.)*

Mounting and unmounting devices

Hard drives and other devices may be mounted (placed on the desktop) and unmounted (removed from the desktop) at any time as long as they are not the current startup drive.

To mount or unmount a drive:

- Select the drive to be mounted or unmounted by clicking once on the drive in the main window.
- Click the **Mount** or **Unmount** button to add or remove the device from the desktop.

Hard Disk ToolKit Mount and Unmount buttons

Updating drivers

All disks contain some invisible files called drivers, which instruct the computer how to interact with that disk. Update this driver file if the disk is not mounting properly or if the Disk First Aid™ utility cannot successfully repair a disk.

Back up all data on the hard drive before attempting this procedure.

To update a disk's driver:

- Select the disk in the main window.
- Select **Update Driver** from the **Devices** menu. Click **OK** to install the new driver.
- Restart the computer.

*(**1.X**: Select* **Update Driver** *from the* **File** *menu.)*

Formatting drives

Hard Disk ToolKit is used to format SCSI hard drives installed in Power Computing computers. Formatting is necessary to prepare all new drives for use in the computer and to remedy severe software corruption on an existing drive.

Formatting destroys all data contained on a disk. Back up all data, if possible, before attempting this procedure on an existing drive.

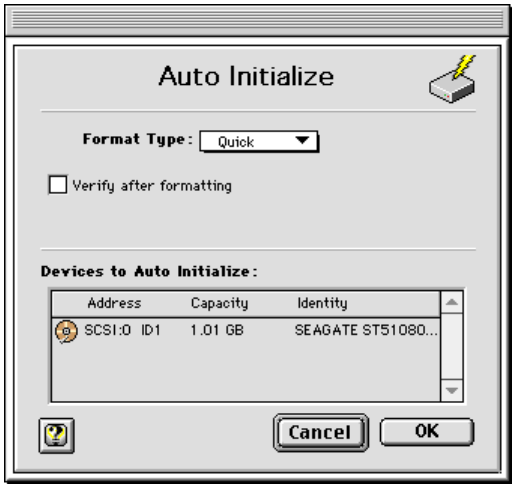
To format a hard drive:

- Select the drive to be formatted in the main window.
- Click the **Auto Initialize** button to begin the process.

Hard Disk ToolKit
Auto Initialize button

- Select options in the **Auto Initialize** dialog box. Choose **Quick** or **Low Level** from the pop-up list. Quick initializes the drive, nullifying pointers to all data on the drive, making it appear empty. Low Level reformats the drive, checking the disk surface and reallocating any bad blocks it encounters. Low Level is required for new drives, and is recommended when software corruption is suspected. **Verify after formatting** asks Hard Disk Toolkit to double-check the disk after the initialization or format is complete. Click **OK** to continue.

Hard Disk ToolKit Auto Initialize dialog box

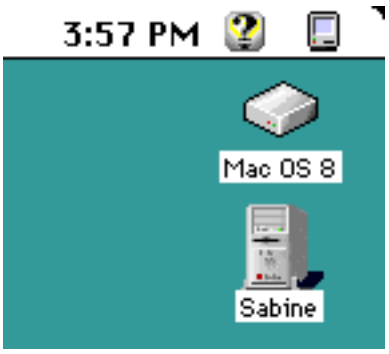


• Click **OK** to dismiss the two warnings that appear.
*(**1.X:** Clicking the* **Format** *button is equivalent to selecting Low Level in version 2.X; selecting* **Initialize** *from the* **File** *menu is equivalent to choosing Quick. Version 1.X prompts for a partition type when formatting or initialization is completed. Choose the default selection,* **Maximum Macintosh**.*)*

Partitioning Drives

Partitions are separate divisions of usable space on a hard drive. Hard Disk ToolKit can create several partitions on a single disk. Each partition appears on the desktop with its own icon, giving the appearance of having multiple hard drives in the computer. The icons below represent two partitions on a single hard drive

Two volumes on a single disk

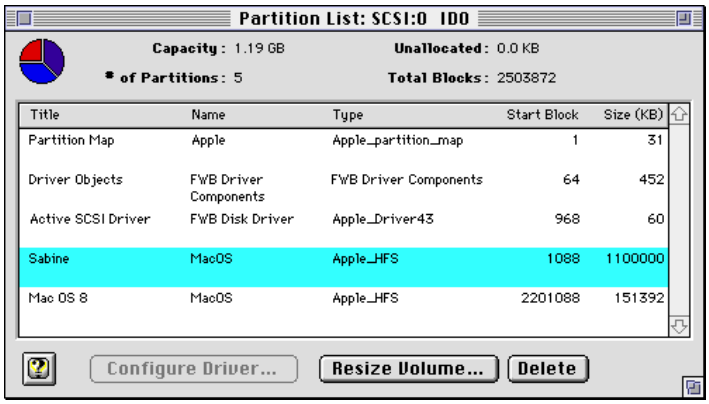


Back up all data on the hard drive before attempting this procedure.

To partition a drive:

• Double-click on the disk in Hard Disk Toolkit's main window, or select the drive and choose **View Partitions** from the **Devices** menu.

Hard Disk ToolKit partition window



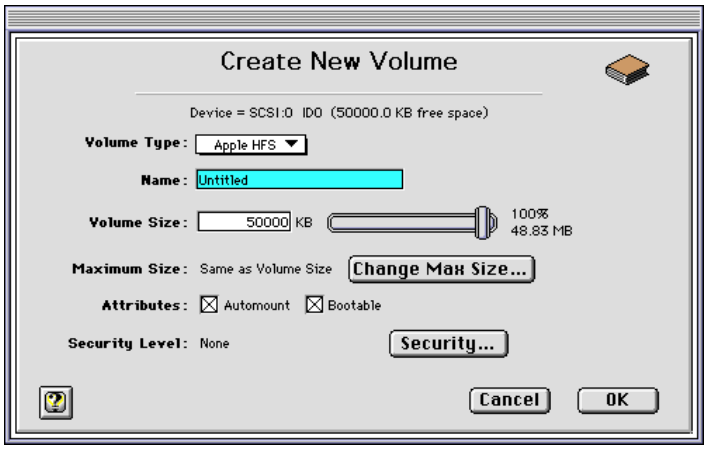
• Existing Apple HFS partitions must be reduced in size to make room for any additional partitions. Select the an existing Apple HFS partition and click the **Resize Volume...** button.

Hard Disk ToolKit Resize Volume dialog box

• Enter the new size for the existing partion and click **OK**. Click **OK** to confirm the operation.

• Select **Create New Volume** from the **Devices** menu.

Hard Disk ToolKit New Volume dialog box



- Enter a name for the partition and select the volume's size. Click **OK**.

Testing drives

Use Hard Disk Toolkit to test the condition of a hard drive when repeated problems have been experienced. This is particularly useful when a drive has already been formatted and has been tested with the Disk First Aid utility. Hard Disk ToolKit will return pass/fail results on several tests and report the number of bad blocks found on the disk. Replace the hard drive if tests fail or if an excessive number of bad blocks are found.

To test a hard drive:

- Select the hard drive to be tested in the main window.
- Click the **Test** button.

Hard Disk ToolKit Test button

- A log file may be saved to another disk, if desired. Select a location or click **Cancel**.
- View the test results.

*(**1.X:** There is no option to save a log file.)*

Drive Setup

Apple's Drive Setup is the primary software tool used to work with EIDE hard drives in Power Computing computers. Use this software to:

- Mount drives
- Format new and replacement hard drives
- Partition hard drives

Drive Setup cannot operate on the drive from which it is running. The most convenient way to use Drive Setup is to boot the computer from the Power CD before launching the software.

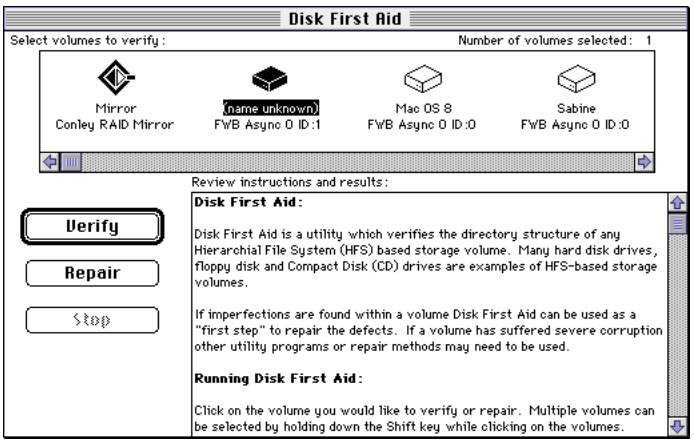
Mounting drives

Hard drives and other devices may be mounted (placed on the desktop) at any time.

To mount an EIDE hard drive:

- Select the drive to be mounted by clicking once on the drive in the main window.

Disk First Aid main window


Disk First Aid
Select volumes to verify:
Number of volumes selected: 1
Mirror
Conley RAID Mirror
(name unknown)
FWB Async 0 ID:1
Mac OS 8
FWB Async 0 ID:0
Sabine
FWB Async 0 ID:0
Review instructions and results:
Verify
Repair
Stop
Disk First Aid:
Disk First Aid is a utility which verifies the directory structure of any Hierarchial File System (HFS) based storage volume. Many hard disk drives, floppy disk and Compact Disk (CD) drives are examples of HFS-based storage volumes.
If imperfections are found within a volume Disk First Aid can be used as a "first step" to repair the defects. If a volume has suffered severe corruption other utility programs or repair methods may need to be used.
Running Disk First Aid:
Click on the volume you would like to verify or repair. Multiple volumes can be selected by holding down the Shift key while clicking on the volumes.

- Select **Mount Volumes** from the **Functions** menu to mount the drive.

Updating drivers

All disks contain some invisible file called drivers, which instruct the computer how to interact with that disk. Update this driver file if the disk is not mounting properly or if the Disk First Aid utility cannot successfully repair a disk.

Back up all data on the hard drive before attempting this procedure.

To update a disk's driver:
- Select the disk in the main window.
- Select **Update Driver** from the **Functions** menu. Click **OK** to confirm the operation.
- Restart the computer.

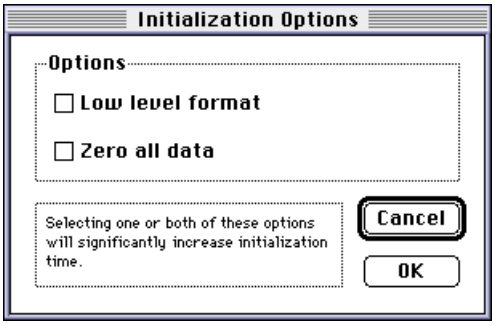
Formatting drives

Drive Setup is used to format EIDE hard drives installed in Power Computing computers. Formatting is necessary to prepare all new drives for use in the computer and to remedy severe software corruption on an existing drive.

Formatting destroys all data contained on a disk. Back up all data, if possible, before attempting this procedure on an existing drive.

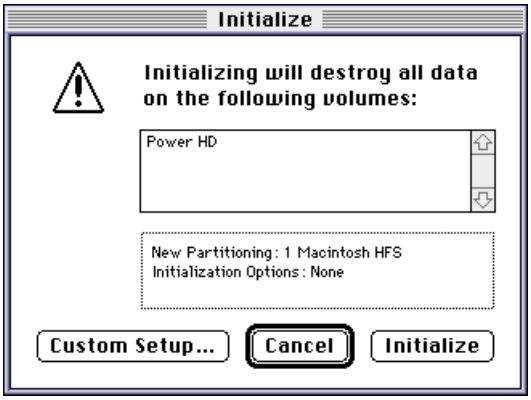
To format a hard drive:
- Select the drive to be formatted in the main window.
- Select the level of initialization to be performed. By default, a quick initialization will be performed unless another option is chosen. Quick initialization erases pointers to any existing data, making the disk appear empty. Two other options are available by selecting **Initialization Options** from the **Functions** menu.

Drive Setup Initialization Options dialog box



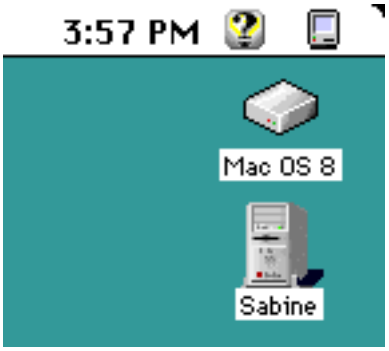
- Select any added options. **Low level format** checks the surface of the disk, and reallocates any bad blocks it encounters. This option is recommended for new drives and in cases of repeated corruption on an existing drive. **Zero all data** sets all bits on the disk to a zero state, rather than leaving them in a random state. Click **OK** to continue.
- Click the **Initialize** button in the main window.

Drive Setup
Initialize dialog box



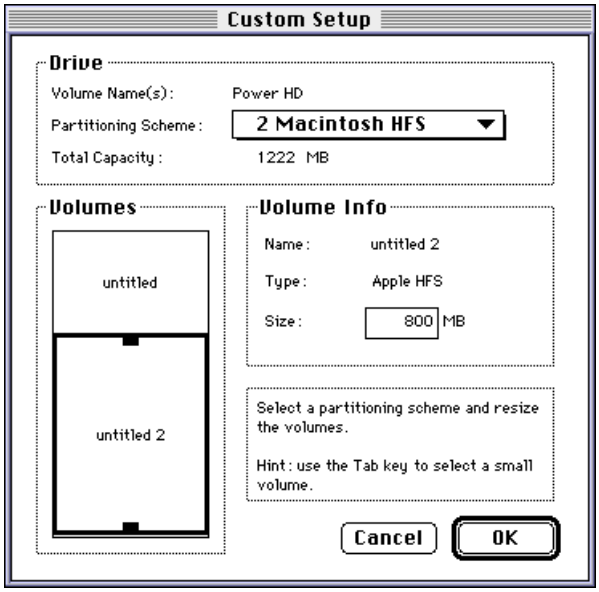
• The disk may be divided into more than one partition during the initialization process. Partitions are separate divisions of usable space on a hard drive. Drive Setup can create several partitions on a single disk. Each partition appears on the desktop with its own icon, giving the appearance of having multiple hard drives in the computer. The icons below represent two partitions on a single hard drive

Multiple volumes on a single disk



• Click the **Custom Setup...** button to create more than one partition. Otherwise, click **Initialize** to complete the process.

Drive Setup Custom Setup dialog box



• Select the desired number of partitions from the **Partition Scheme** pop-up list. Drag the sliding bars in the **Volumes** column to adjust the sizes of the partitions. Click **OK** to complete the initialization.

Iomega Tools

Iomega Tools™ is provided for the setup and maintenance of Zip and Jaz drives. Use this software to:

- Format new Zip and Jaz disk cartridges
- Mount Zip and Jaz disks
- Change options for drive operation

Iomega Tools is made up of several components: the Tools application, an Iomega Drive Options™ application that is stored in the Control Panels folder, and an Iomega Driver system extension. The Iomega Driver must be installed in the System Folder and made active by the Extensions Manager for the drive to operate.

Formatting disks

The Iomega Tools application is used to format new disks to prepare them for use, or to correct severe software corruption on a disk.

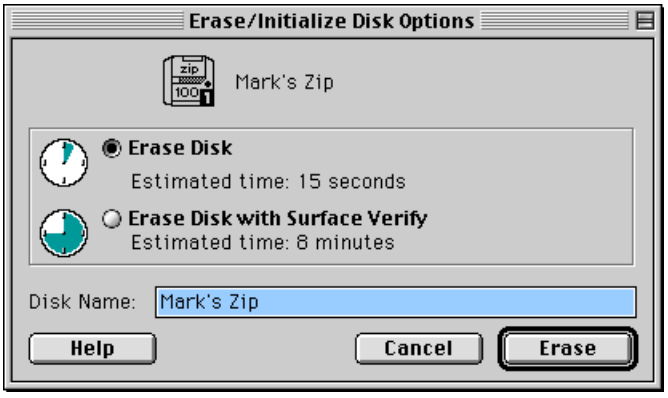
Formatting destroys all data contained on a disk. Back up all data, if possible, before attempting this procedure on an existing disk.

To format a disk:

- Insert the disk in the drive.

Iomega Tools main window

- Select the disk in the main window.
- Click the **Erase** button.



Iomega Tools Erase Options dialog box

- Select the type of erase function to be preformed. The **Erase Disk** option initializes the disk, eliminating pointers to any existing data, making the disk appear empty. **Erase Disk with Surface Verify** examines the disk surface and reallocates any bad blocks it encounters. This option is recommended for new disks and when repeated software corruption has occurred with a particular disk.
- Enter the name to be given to the disk. Click **Erase**.

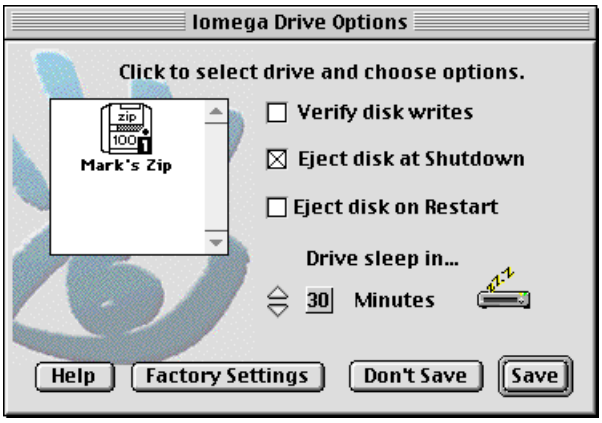
Changing drive options

The Tools and Drive Options applications offer several options to customize the operation of Zip and Jaz drives.

To change drive options:

• Open the Tools application and click the **Options** button, or open the Iomega Drive Options application directly.

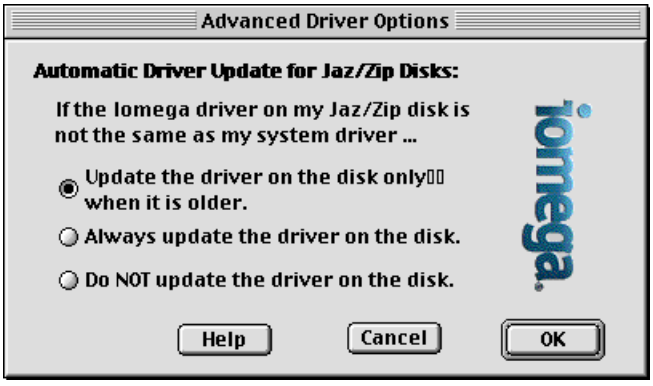
Iomega Drive Options dialog box



• Select the desired options. Click the **Help** button for more information about each option.

• Select **Advanced Options...** from the **Special** menu to change options relating to disk drivers.

Iomega Drive Options Advanced Options dialog box


Advanced Driver Options
Automatic Driver Update for Jaz/Zip Disks:
If the Iomega driver on my Jaz/Zip disk is not the same as my system driver ...
Update the driver on the disk only when it is older.
Always update the driver on the disk.
Do NOT update the driver on the disk.
Help
Cancel
OK

• Make your selection and click **OK**.

• Click **Save** in the Drive Options window.

Disk First Aid

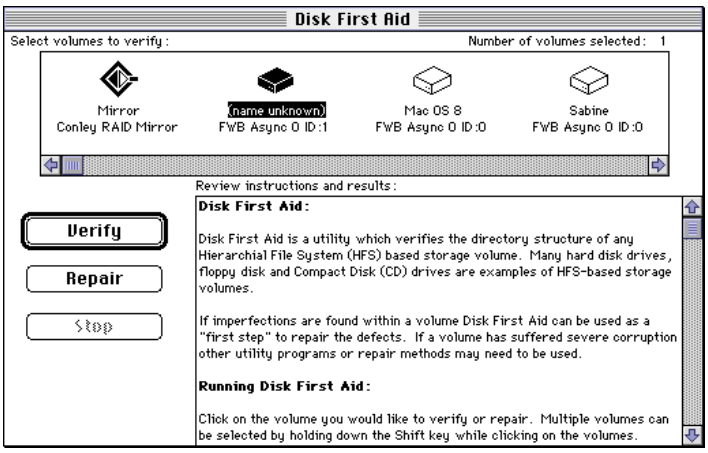
Apple's Disk First Aid is a disk repair utility used to examine the directory structure of a hard drive or other HFS partitioned disk. Use this program to correct suspected software corruption. Disk First Aid will correct the mechanisms the Mac OS uses to keep track of where files are located on a disk; it will not correct problems with the content of files.

Disk First Aid cannot operate on the drive from which it is running. The most convenient way to use Disk First Aid is to boot the computer from the Power CD before launching the software.

To repair a disk:

- Select the disk to be repaired in Disk First Aid's main window.

Disk First Aid main window


Disk First Aid
Select volumes to verify:
Number of volumes selected: 1
Mirror
Conley RAID Mirror
(name unknown)
FWB Async 0 ID:1
Mac OS 8
FWB Async 0 ID:0
Sabine
FWB Async 0 ID:0
Review instructions and results:
Verify
Repair
Stop
Disk First Aid:
Disk First Aid is a utility which verifies the directory structure of any Hierarchial File System (HFS) based storage volume. Many hard disk drives, floppy disk and Compact Disk (CD) drives are examples of HFS-based storage volumes.
If imperfections are found within a volume Disk First Aid can be used as a "first step" to repair the defects. If a volume has suffered severe corruption other utility programs or repair methods may need to be used.
Running Disk First Aid:
Click on the volume you would like to verify or repair. Multiple volumes can be selected by holding down the Shift key while clicking on the volumes.

- Click **Repair**.
- View the results. If Disk First Aid reports that it cannot repair a disk, update the disk's driver and try the repair again. Reformat the disk if Disk First Aid still cannot repair it.

Other Disk Repair

Several third-party software companies offer disk repair utilities similar to Disk First Aid. Symantec®'s Norton Utilites™ is one of the more widely used examples. While Power Computing cannot support the use of these utilities, customers may find them useful and may use them at their own risk.

CD-ROM ToolKit

FWB's CD-ROM TookKit ™ controls the operation of CD-ROM drives installed in Power Computing computers. It also gives the computer the ability to read different types of data, multimedia, audio, and hybrid cds. CD-ROM ToolKit must be installed in the System Folder and made active in order for the computer to read CD-ROMs.

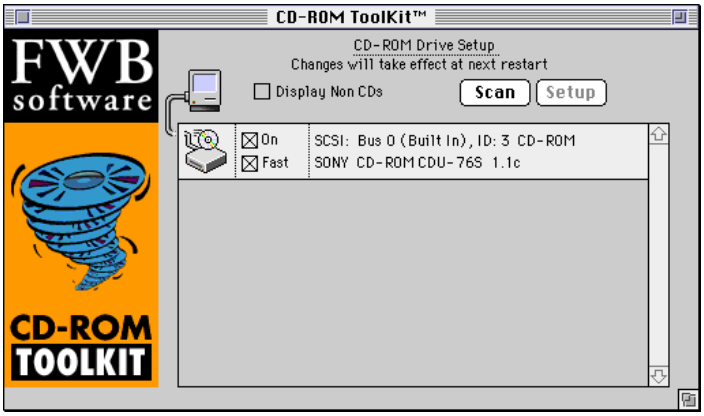
Note: CD-ROM ToolKit underwent substantial changes in the revision to version 2.X. Although the locations have changed, most commands have remained the same. The examples given below are for version 2.X; important notes for users of version 1.6.3P and earlier are provided at the end of each of the following sections.

CD-ROM ToolKit is composed of two parts: a system extension and an application. The extension must be installed in the Extensions Folder and made active by the Extensions Manager for the CD-ROM drive to operate. The application is normally located in the Control Panels folder in the System Folder. *(**1.X:** Version 1.6.3P and earlier are composed of one part, a control panel.)*

Setup options

CD-ROM Toolkit has many options available to customize the setup and operation of the CD-ROM drive. In most cases, the default settings work well and do not need to be changed. However, changes are easy to make:

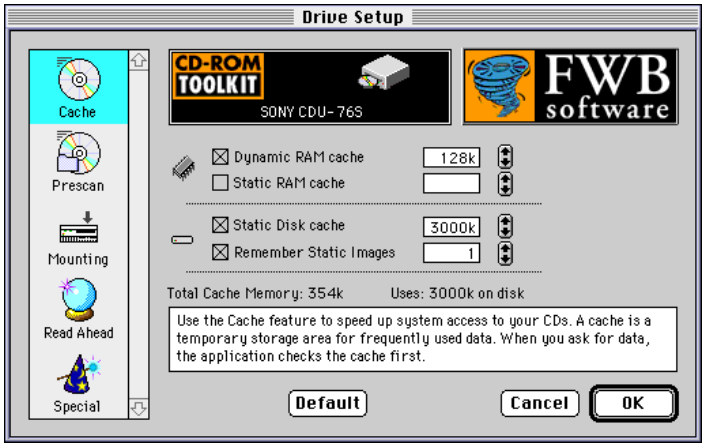
- Open the CD-ROM ToolKit application.



CD-ROM TookKit main window

- Click once on the CD-ROM icon to select the drive.
- The **On** check box must be selected for the CD-ROM drive to operate.
- Click the **Setup** button to access other options.

CD-ROM ToolKit Drive Setup dialog box



- Select the category of options you wish to change by clicking once on its icon in the left side of the window.
- Make the desired changes and click **OK**. CD-ROM ToolKit provides a brief explanation of each option in the window just above the **OK** button.
- Quit the CD-ROM ToolKit application.
- Restart the computer.

*(**1.X:** click the Options button to get access to setup parameters.)*

Installing software from cd

The distribution of software on CD-ROM is convenient, but it leads to a catch-22 situation. Software should be installed with system extensions disabled. However, when extensions are disabled, the computer cannot access the CD-ROM drive. CD-ROM ToolKit provides a solution to this dilemma.

To mount a cd with extensions off:

- Start the computer and hold down the **Shift** key until the message "Welcome to Macintosh. Extensions Disabled." appears.
- Insert the software cd into the drive. It will not mount on the desktop.
- Open the CD-ROM ToolKit application.
- Select **Load CD-ROM Drivers** from the **ToolKit** menu. Click **OK** to confrim the operation. CD-ROM ToolKit will spin up the disk and

mount it on the desktop.

• Quit the CD-ROM ToolKit application.

*(**1.X:** Open CD-ROM ToolKit, then immediately close it again. Click* **OK** *to the messages that appear.)*

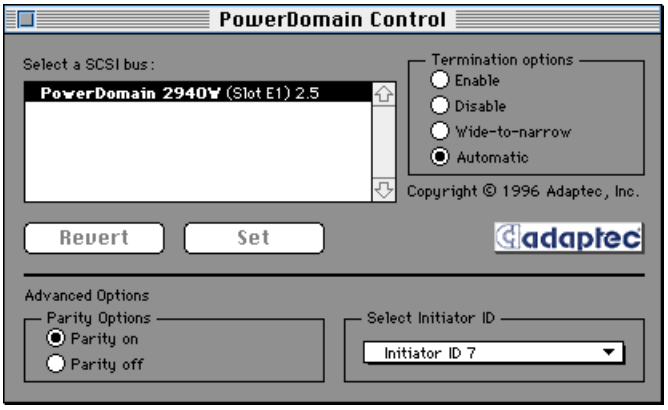
PowerDomain Control/Board Control

Special features of the Adaptec PCI cards are set through control panels. The control panel for the 2940 card is called PowerDomain Control. The 2930 card uses a control panel called Board Control. Options for these cards are largely "set and forget," and it is likely that most users will never even need to change any settings. Power Computing recommends leaving these control panels with their factory-set options.

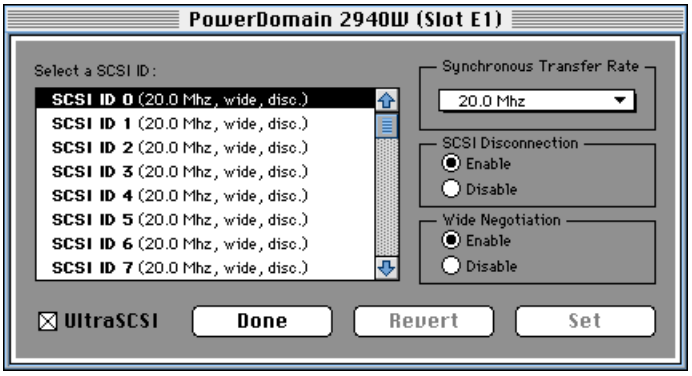
Power Domain Control

For reference, the windows of the control panel and its recommended settings are pictured below

PowerDomain Control main window



PowerDomain Control target options window

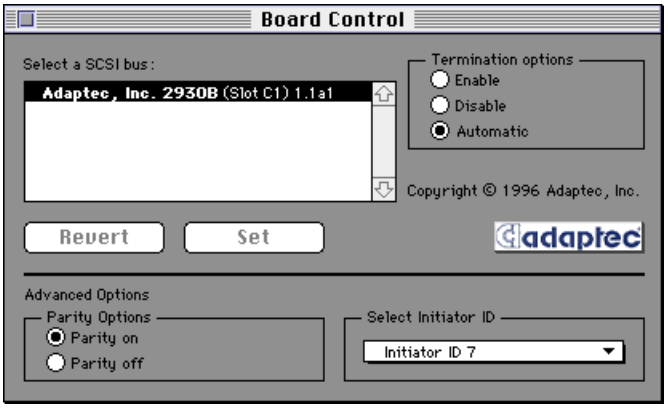


.It is very important that the **Termination options** settings be left at the factory default. Improper use of these settings can result in data loss or damage to the Adaptec card.

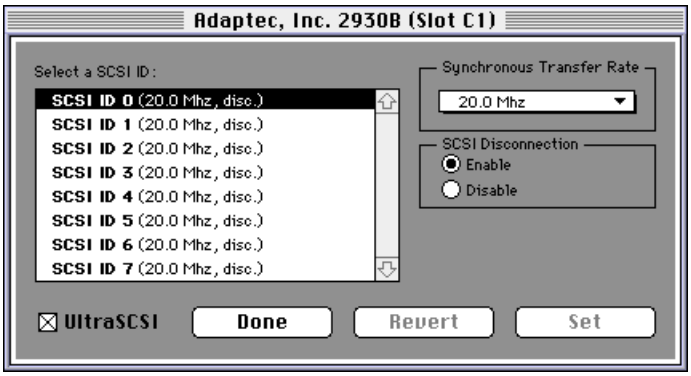
Board Control

For reference, the main window of the control panel and its recommended settings are pictured below.

Board Control main window



Board Control target options window



It is very important that the **Termination options** settings be left at the factory default. Improper use of these settings can result in data loss or damage to the Adaptec card.

RAID

Definition

A Redundant Array of Inexpensive Disks (RAID) provides a cost-effective solution for high-performance disk needs. At its most simple level, a RAID system is comprised of two or more hard drives working together through the use of a software application.

The basis for RAID systems lies in the distinction between partitions and volumes. Partitions are physical divisions of a hard drive's available storage space. Volumes are the logical manner in which the computer makes use of that available space. On a computer with a single disk, there is one volume on each partition. On a computer with multiple disks, partitions from different disks may be combined to create a single volume.

RAID Levels

There are several methods of combining disk partitions into a RAID system, known as RAID Levels. Power Computing supports the most popular levels, 0 (striping) and 1 (mirroring).

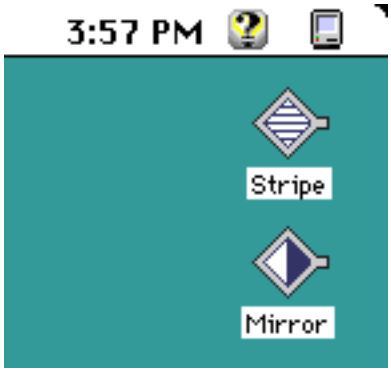
RAID Level 0 (Striping)

Striping attains higher disk performance by splitting a data file across multiple disk drives. One partition on each of two or more drives are combined into a single volume. As a file is written, the RAID software splits it into chunks, which are then divided among the separate partitions. Writing a file to a disk ordinarily results in the computer waiting for the drive to write information to its disk platter before sending more data. A striped volume gets is speed by sending information to the next available partition while the first disk is in the process of writing. The result is much less waiting by the computer. These speed gains are not without cost, however. Because no single drive in the striped volume contains a complete data file, the security of that data is relatively low. If one drive in the striped volume fails for any reason, all of the data in the volume will be lost. For this reason, it is critical that data on a striped volume be backed up regularly to another device.

RAID Level 1 (Mirroring)

Mirroring attains higher data security by writing the same file on multiple disk drives. The RAID software addresses a data file to multiple partitions, so each drive writes the same information simultaneously. One partition in the mirrored volume is designated as the primary partition, and data is written to and read from this area. The other partitions are mirrors of the primary partition, and data is written to them automatically, but not read from them unless needed. Data may be read from any of the mirrored partitions if the primary partition fails. Mirrored volumes are, in effect, an automatic back-up system. For full security, however, it is still recommended that data be backed up to some other independent disk.

Striping and mirroring may be combined in a RAID system by dividing the drives into multiple partitions. This process will be described in more detail later in this section. The icons below represent a striped volume and a mirrored volume created on a RAID system containing two disks.



Icons for striped and mirrored volumes of a RAID system

Other levels

RAID specifications include several other levels for specific applications. Power Computing does not support the use of these levels.

Level 2. This level provides error correction and detection for hard drives that do not do this automatically. All SCSI devices support built-in error detection, so RAID Level 2 is rarely used on the Macintosh platform.

Level 3. This level stripes data across several drives at a byte level, with parity information stored on a single drive. This provides some addi-

tional data security above Level 0, but requires additional hardware to operate.

Level 4. This level stripes data across several drives at a block level, with parity stored on one drive. This level also offers some additional data security above Level 0, as data can be recovered as long as the parity information can be accessed. Level 4 is commonly used on large file servers.

Level 5. This level is similar to Level 4, but parity information is distributed among all drives. This level is often used in database servers.

Power Computing RAID systems

Power Computing sells preconfigured RAID systems as an option for the PowerTower Pro. The system consists of two hard drives, an Adaptec 2940 PCI card, special high-grade SCSI cable, and Conley® SoftRAID™ software. The drives are set up by Power Computing in either a striped or mirrored configuration. A RAID system is normally sold in addition to, not in place of, the normal hard drive.

The locations of the components are designed to keep the cabling as short as possible to further improve the speed and reliability of the system. The Adaptec 2940 card is installed in the top PCI slot. The two hard drives are installed in a special cage, known as the RAID rack, located on the crossbar on the middle of the chassis. A three-head SCSI cable approximately one foot long connect the devices. The drive connected to the middle position of the SCSI cable is set to ID 1 and is unterminated. The drive connected to the end of the SCSI cable is set to ID 0 and is terminated.

Conley SoftRAID

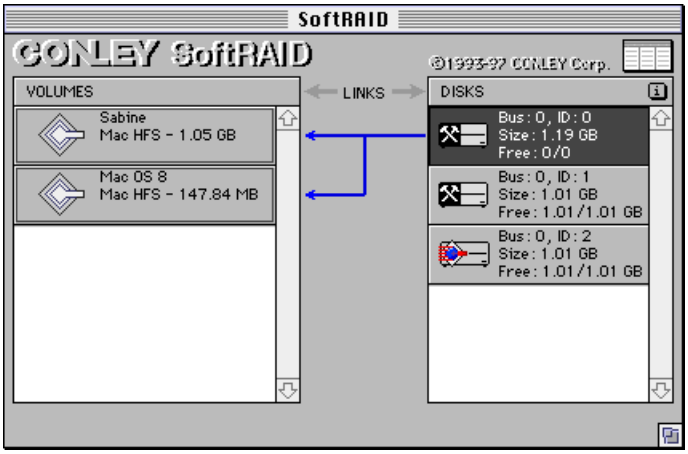
SoftRAIDis the software application that configures and controls RAID systems sold by Power Computing. Use SoftRAID to:

- Format hard drives
- Create striped volumes
- Create mirrored volumes
- Update disk drivers

SoftRAID is composed of two components: the SoftRAID application, and a system extension called SoftRAID Monitor. The application is used for the configuration of the RAID system, and does not need to be

running for the array to function. The SoftRAID Monitor extension must be installed in the System Folder and made active by the Extensions Manager. To use SoftRAID, boot the computer from a disk other than one used for the RAID array.

SoftRAID main window



SoftRAID shows the relationships among disks, partitions, and volumes by drawing arrows between the columns. Click once on the icon for a disk, for example, to see which partitions and volumes are associated with that disk. The default view contains the **Volumes** and **Disks** columns only. Select **Show/Hide Partitions** from the **Disk** menu to add or remove a column showing all partitions.

Mounting volumes

SoftRAID can mount volumes at any time. To mount a volume:

- Select the volume to be mounted
- Choose **Mount** from the **Volume** menu

Formatting drives

Use SoftRAID to format any disk drives to be used in the RAID array. Formatting is required to prepare all new drives for use, and is recommended when repeated software corruption has been experienced on a particular disk.

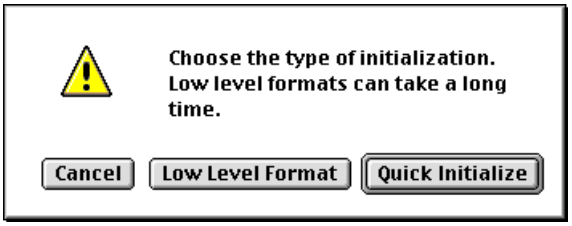
Formatting destroys all data contained on a disk. Back up all data, if possible, before attempting this procedure on an existing drive.

To format a disk:

- Select the disk in the main window.

• Choose **Initialize...** from the **Disk** menu.

SoftRAID Initialize dialog box



• Select **Low Level** or **Quick Initialize**. Low Level verifies the surface of the disk platters, and reallocates and bad blocks it encounters. Low Level is required for new drives and is recommended if software corruption is suspected. Quick Initialize eliminates any pointers to existing data, making the drive appear empty. Click **OK** to confirm the operation.

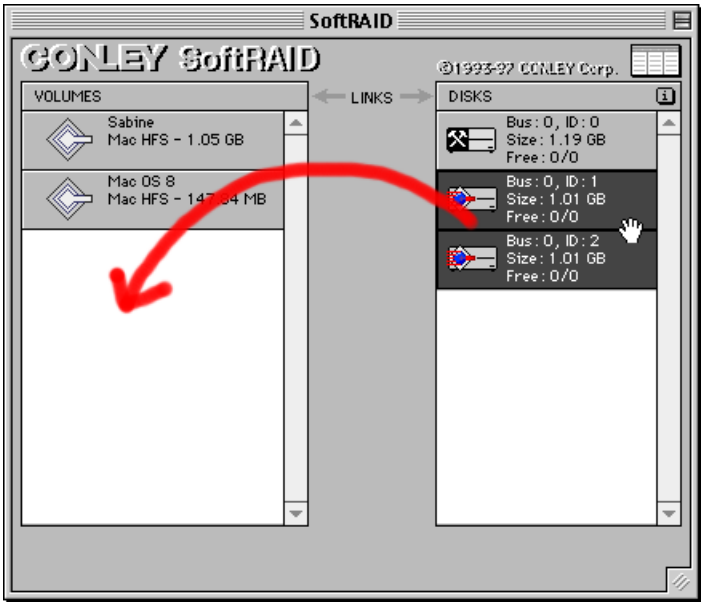
Creating a striped volume

To use RAID Level 0, create a new striped volume. This volume can be made from partitions on two or more hard drives.

To create a striped volume:

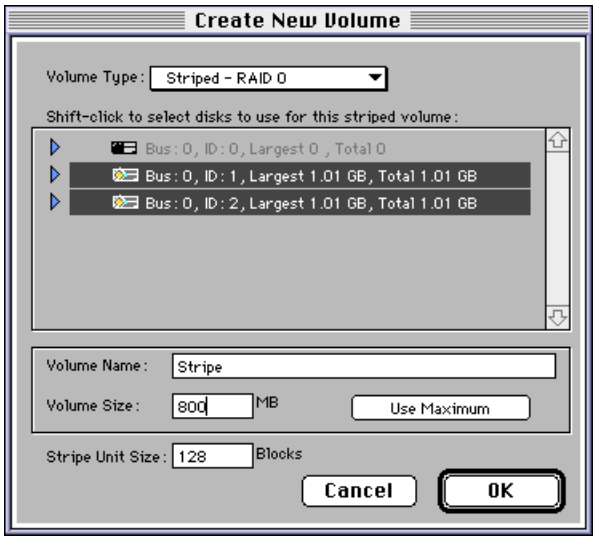
• Shift-click the icons for the hard drives to be used in the **Disks** column.

SoftRAID main window with disks selected for a new striped volume



• Drag the disk icons to the **Volumes** column to open the **New Volume** dialog box.

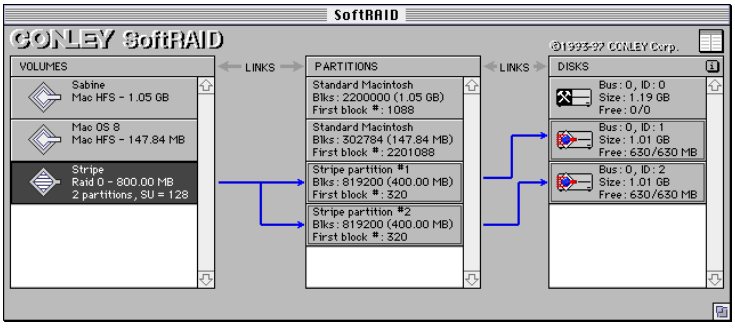
New striped volume dialog box


Create New Volume
Volume Type: Striped - RAID 0
Shift-click to select disks to use for this striped volume:
Bus: 0, ID: 0, Largest 0 , Total 0
Bus: 0, ID: 1, Largest 1.01 GB, Total 1.01 GB
Bus: 0, ID: 2, Largest 1.01 GB, Total 1.01 GB
Volume Name: Stripe
Volume Size: 800 MB
Use Maximum
Stripe Unit Size: 128 Blocks
Cancel
OK

• Select **Striped—RAID 0** from the **Volume Type** pop-up list.
• Enter a name for the volume.
• Select a size for the volume. Sizes of striped volumes are additive. The 800 MB volume shown above uses 400 MB from each disk.
• Leave the **Stripe Unit Size** at its default value.
• Click **OK** to create the volume.

The window below shows the newly created striped volume and its associated partitions.

SoftRAID window showing a new striped volume



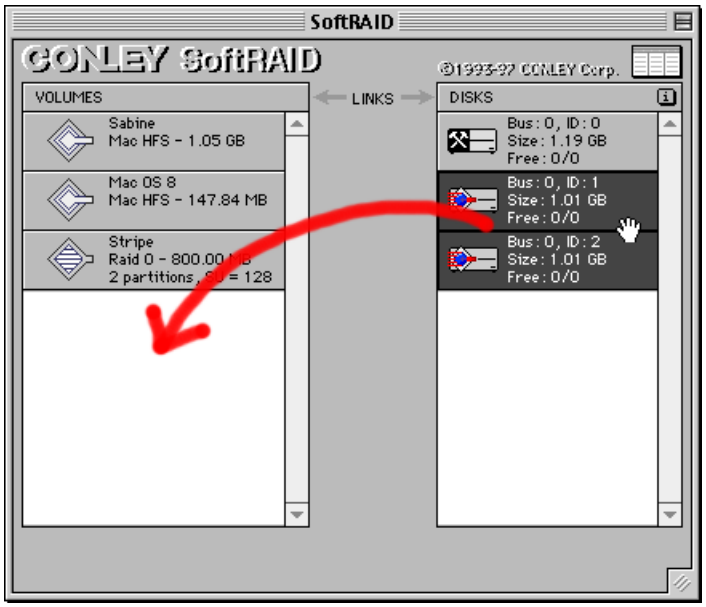
Creating a mirrored volume

To implement RAID Level 1, create a new mirrored volume. The volume may be created from two or more disks.

To create a mirrored volume:

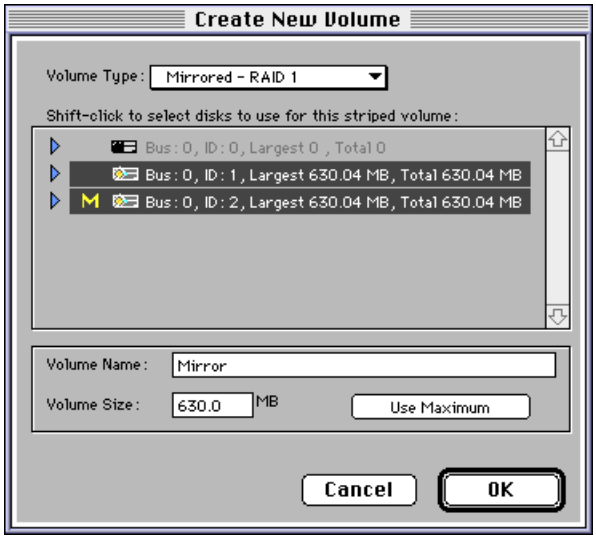
• Shift-click the icons for the hard drives to be used in the Disks column. The first disk selected will contain the primary partition. All other disks will contain mirrored partitions.

SoftRAID main window with disks selected for a new mirrored volume



• Drag the disk icons to the Volumes column to open the **New Volume** dialog box.

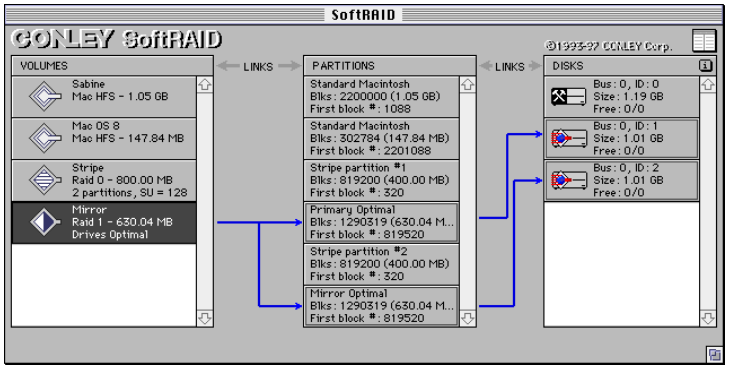
New mirrored volume dialog box



- Select **Mirrored—RAID 1** from the **Volume Type** pop-up list.
- Enter a name for the volume.
- Select a size for the volume. The selected size is the amount of space to be used on each disk.
- Click **OK** to create the volume.

The window below shows the newly created mirrored volume and its associated partitions.

SoftRAID window showing a new mirrored volume



Updating disk drivers

All disks contain some invisible file called drivers, which instruct the computer how to interact with that disk. Update this driver file if the disk is not mounting properly or if the Disk First Aid utility cannot successfully repair a disk.

Back up all data on the disk's volumes before attempting this procedure.

To update a disk's driver:

- Select the disk in the main window.
- Select **Install Driver** from the **Disk** menu. Click **OK** to install the driver.
- Restart the computer.

Troubleshooting

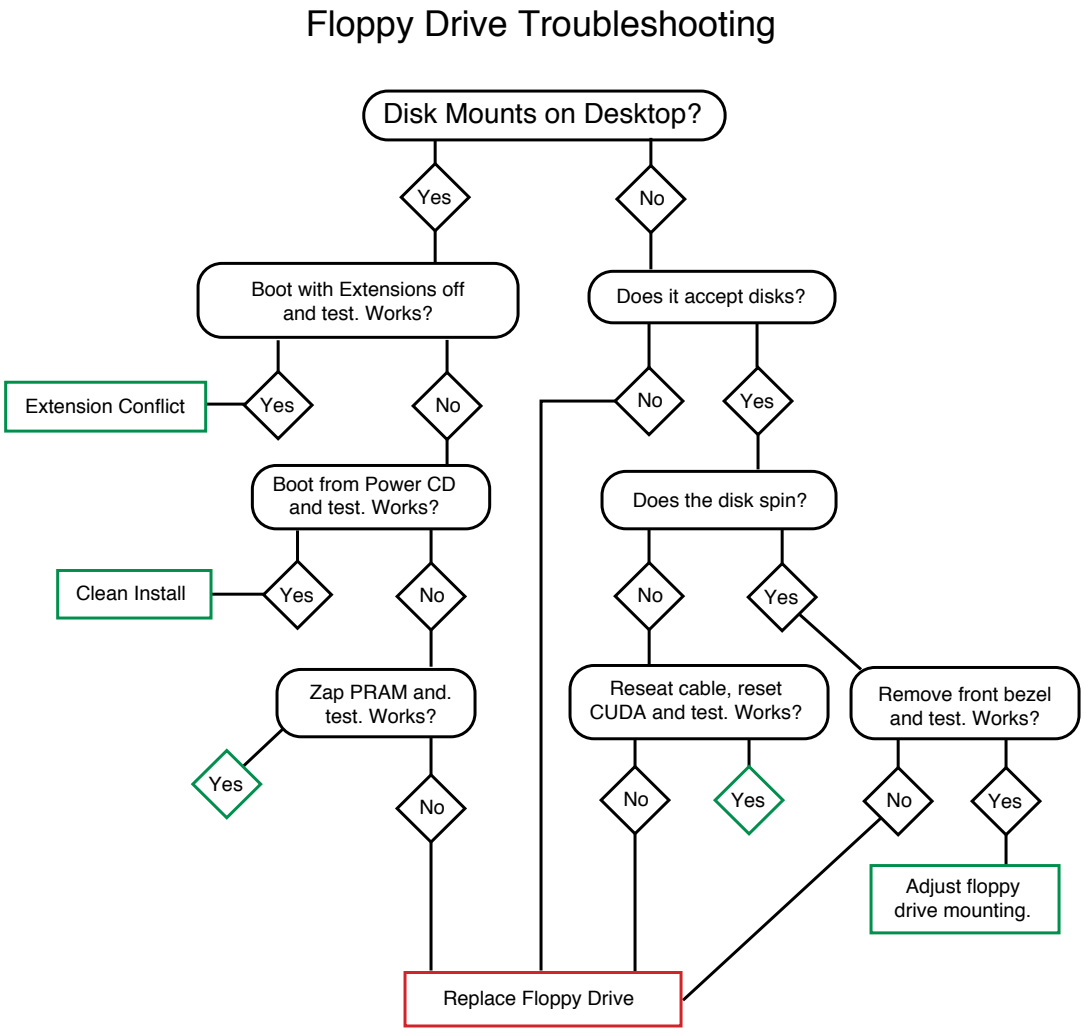
Difficulty with storage devices can be an alarming situation for a user, as it often severely limits use of the computer, and in some cases, prevents the computer from functioning at all. The number of components involved can make isolating a problem seem daunting. However, proper troubleshooting with a "divide and conquer" approach will often lead to quick results.

The first step in troubleshooting problems with any type of storage device is to get the computer back to its original factory configuration, disconnecting any peripherals, and if possible, disabling added software. Similarly, ask the question, "What has changed?" If some change to the computer's configuration was made immediately before the problem began, such as adding more RAM or a new scanner, restore the original configuration before proceeding. This will quickly determine if the problem lies with Power Computing hardware or with third-party devices. Specific actions for each type of storage device follow in the sections below.

Floppy Disk Drive

Because of the simplicity of the floppy disk drive, there are a limited number of problems a user may experience. Normally, there is either a software problem that prevents a disk from operating properly, or a hardware problem that requires replacement of the floppy drive.

Follow the flowchart below to troubleshoot problems with floppy drives.



Hard Disk Drive

Problems with the hard disk drive are among the most common type of difficulty encountered by users. Several types of problems may be expected: corruption of software; improper setup of a drive; failure of electronic components on the drive; physical failure of the drive mechanism. Hard disk problems can occationally result in system errors, but will most often lead to problems booting the computer. Follow the instructions or flowcharts below according to the type of symptom encountered.

Gray Screen at startup

Freezing with a gray screen duning startup is a sure sign of problems with a SCSI device. The computer polls the SCSI bus shortly after the computer is turned on, and if the CPU cannot interpret the results correctly, the boot process will be interrupted. Probable causes are a corrupted driver, an incorrectly configured device or failed electronics on the drive. Follow the Hard Drive Troubleshooting flowcharts below to isolate the cause of the problem.

Flashing question mark at startup

A flashing disk with a question mark indicates the computer was not able to successfully read the System Folder. Common causes are a corrupted System Folder, corrupted driver, or a failed drive. Follow the Hard Drive Troubleshooting flowcharts below to isolate the cause of the problem.

Freezes at Happy Mac

Freezing at the Happy Mac icon indicates the computer has found a System Folder, but was not able to successfully read it. The most likely cause is a corrupted System Folder, but there are several other possibilities. Follow the Hard Drive Troubleshooting flowcharts below to isolate the cause of the problem.

Corrupted Files

Files on a disk may become corrupted over time, leading to software errors or failure of the file to open or save properly. Most software corruption is due to factors other than the hard drive: improper use of external SCSI devices, or poorly written software. Bad sectors on the hard drive or failure of the drive's electronics will, however, cause corruption of the disk as well. Use the following steps to correct the problem:

- Use Disk First Aid to try to correct damaged directory information. Although Power Computing cannot support the use of third-party disk repair utilities, customers may find it worthwhile to use such utilities in addition to Disk First Aid.
- Reformat the disk if Disk First Aid cannot correct the problems it finds.
- Reformat the disk if problems persist after Disk First Aid fixes problems or reports that the disk appears to be okay.
- Replace the hard drive is problems persist after reformatting.

Slow performance

Hard drive performance that is slower than normal may be a result of one or more of these factors: corruption on the disk; fragmentation of the disk; bad sectors on the disk; failure of the drive mechanism. Use the following steps to correct the problem:

- Use Disk First Aid to try to correct damaged directory information.

Although Power Computing cannot support the use of third-party disk repair utilities, customers may find it worthwhile to use such utilities in addition to Disk First Aid.

- Defragment the disk with a third-party utility. Although Power Computing cannot support the use of such software, customers may find those products useful.
- Reformat the disk if Disk First Aid does not resolve the problem.
- Replace the drive if performance remains poor after reformatting.

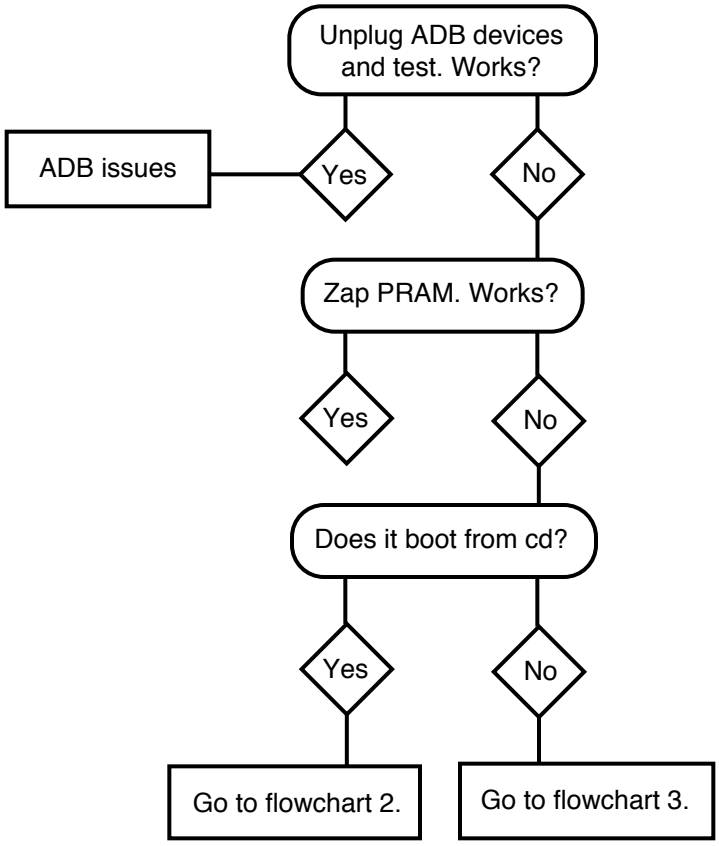
Abnormal noise

Some noises may be indicators of mechanical problems in a disk drive. Loud or uneven rattling, clanging, or grinding sounds are signs of faulty or misaligned parts. Listen for these sounds when troubleshooting other types of problems with the hard disk, as the presence of these noises will confirm the need to replace the drive. Replace the hard drive even if no other symptoms of failure are evident yet, as other problems are likely eminent.

Some sounds may be alarming to users, but are not necessarily an indicator of problems with a hard drive. A high-pitched whine is the most common of these sounds. All hard drives can be expected to make a whining noise to some degree due to the rotation of the disk platters. Some hard drives, especially high-performance hard drives of 7200 rpm or faster, can be quite loud. A high pitched whine can be a sign of faulty spindle bearings inside the drive, however, so use your judgement to determine if the noise is within range for that type of drive.

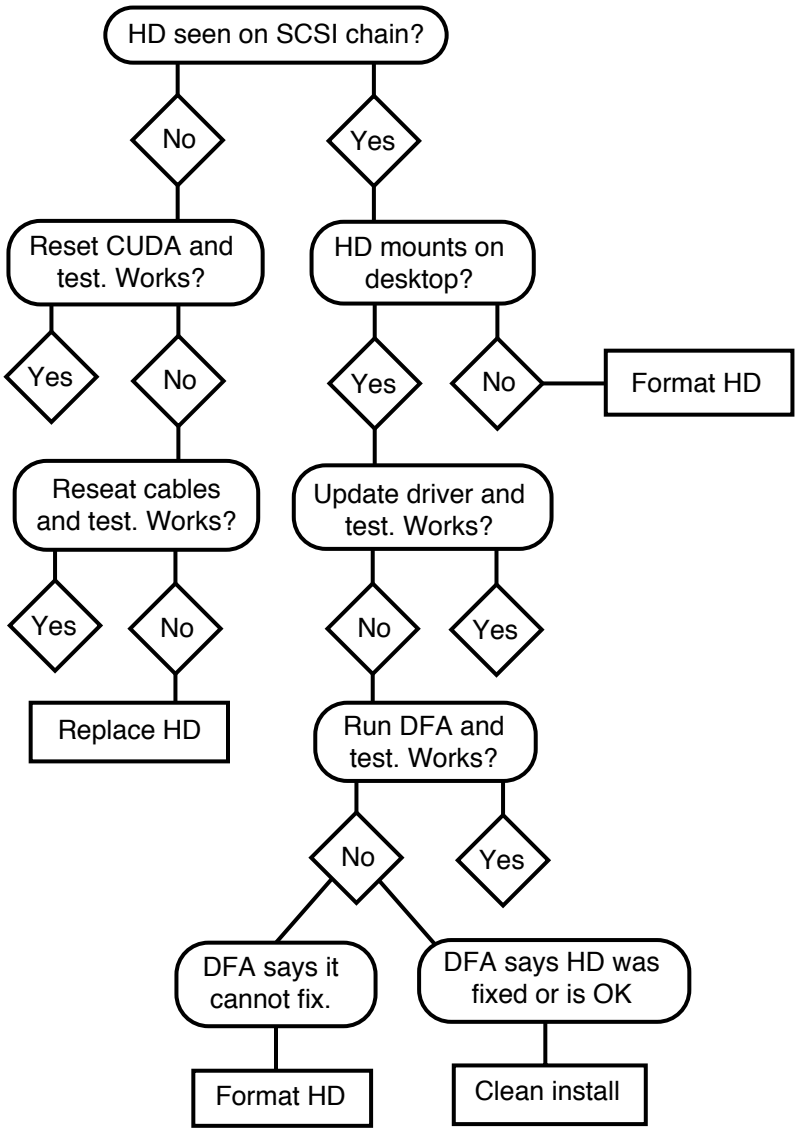
Hard Drive Troubleshooting

1 of 3



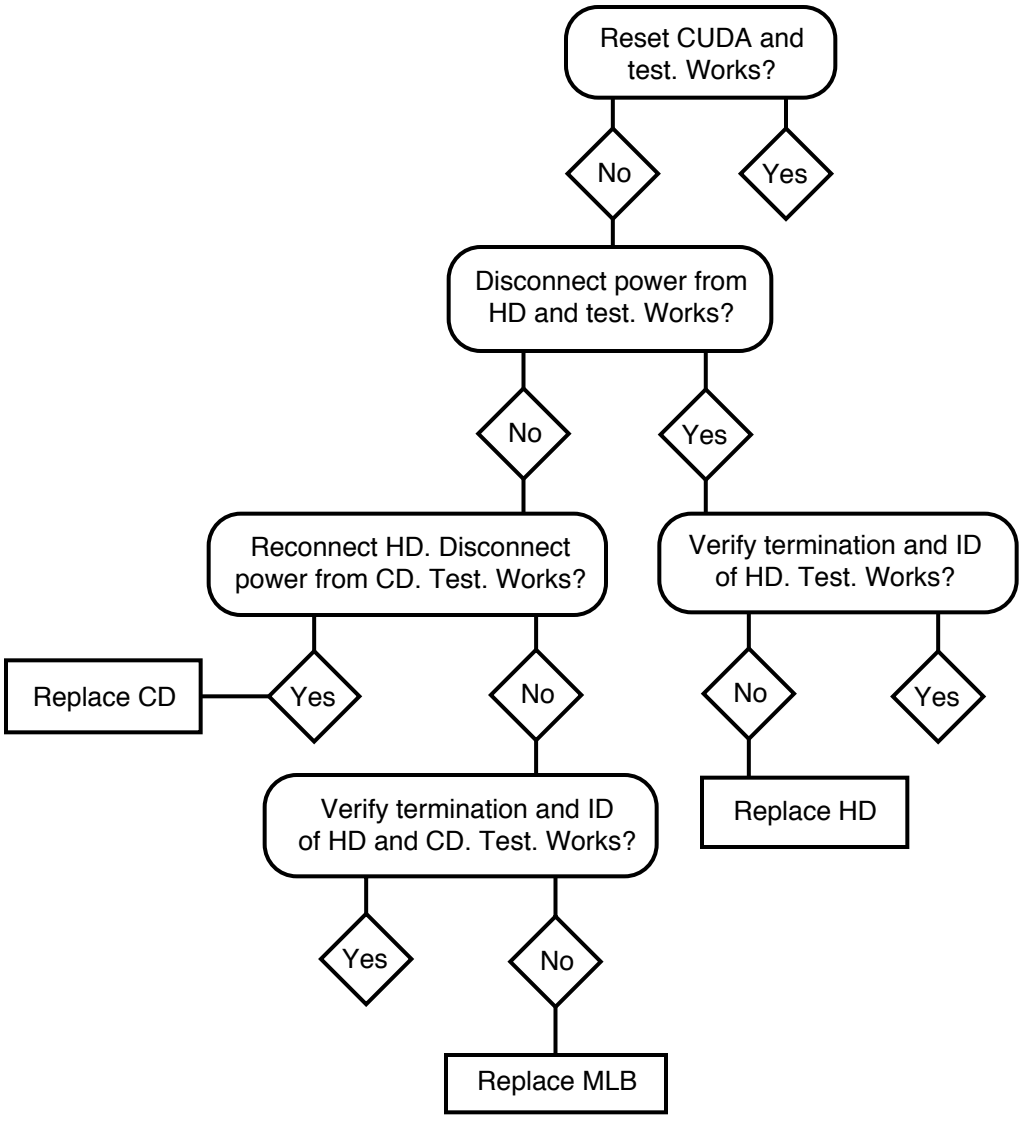
Hard Drive Troubleshooting

2 of 3



Hard Drive Troubleshooting

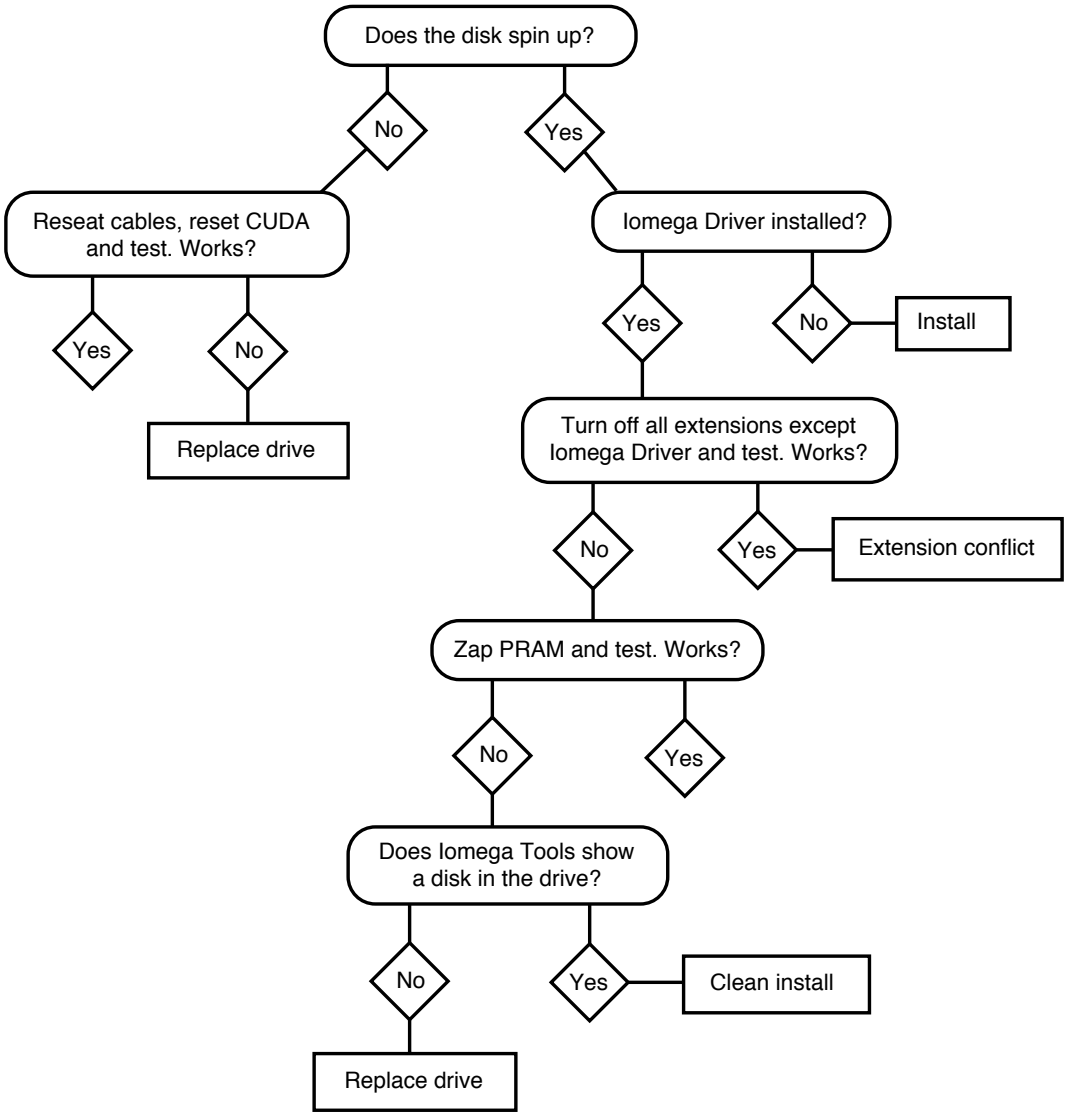
3 of 3



Removeable Disk Drive

The type of problem most often encountered with a Zip or Jaz drive is the failure to mount a disk. The cause may be either software, the drive hardware, or the disk cartridge. Always test with more than one cartridge. Follow the steps in the following flowchart to find the cause of the problem.

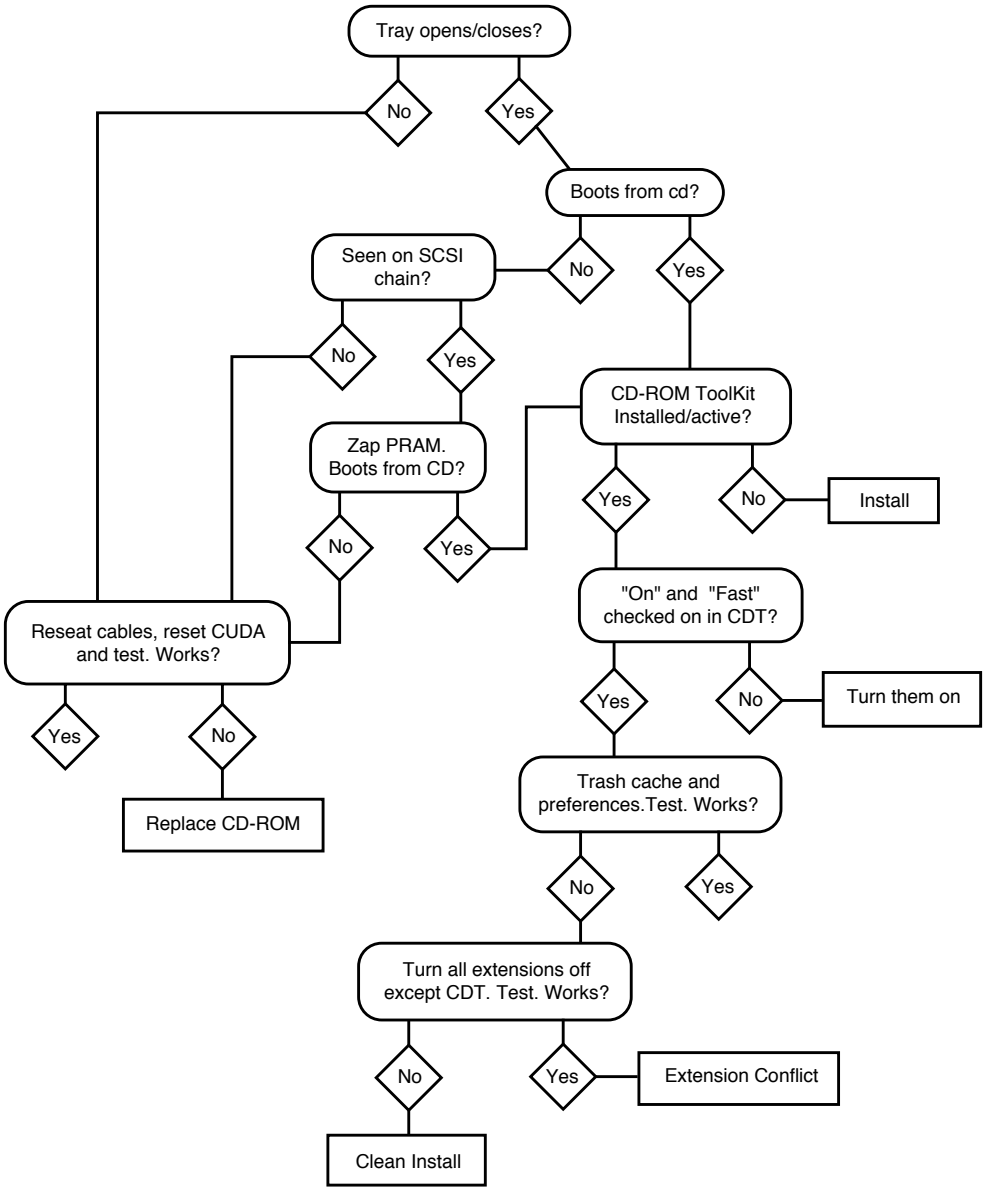
Zip/Jaz Troubleshooting



CD-ROM Drive

The type of problem most often encountered with a cd-rom drive is the failure to mount a disk. The cause may be either software or the drive hardware. Follow the steps in the following flowchart to find the cause of the problem.

CD-ROM Troubleshooting



RAID

Most of the problems encountered by RAID users are same as those for any normally configured hard drive. There are, however, several situations that may arise as a result of the way the disks in the RAID system rely on one another. The Conley SoftRAID Monitor extension continuously checks the operation of the RAID system, and flashes an icon in the menu bar when it detects a problem. Open the SoftRAID application to see what condition is being reported.

Failed stripe

Data in a striped volume may become inaccessible due to one of two problems: corruption on one of the disks or a failed disk. All data on the striped volume will be inaccessible until the condition is cleared. All data on the striped volume will be lost if a drive must be reformatted or replaced. Use the following steps to correct the problem:

- Make sure all disks used for the striped volume are registering on the SCSI bus. If a drive does not appear in SoftRAID, reseat the cables to the drive and reset CUDA. Replace the drive if it still does not appear on the SCSI chain.
- If the drive does appear on the SCSI bus, run Disk First Aid on the striped volume.
- Update the disk driver with SoftRAID.
- Reformat the disk if updating the driver and using Disk First Aid cannot resolve the problem.
- Replace the hard drive if problems persist after the drive has been reformatted.

Mirror out-of-sync

A mirrored volume is said to be “out-of-sync” when SoftRAID cannot guarantee that identical information is stored on each of the partitions.There may or may not be a problem with any of the drives, as a system crash will result in an out-of-sync condition. All data on the mirrored volume will continue to be accessible while the condition is being resolved. Use one or both of the following methods to resolve this problem.

Clear out-of-sync. If a system crash has occurred, and you are confident that no data has been changed since the error was reported, you may simply clear the error condition.

To clear an out-of-sync condition:
• Select the mirrored volume in the SoftRAID window.
• Select **Clear out-of-sync...** from the **Volume** menu. Click the **Clear** button in the confirmation dialog box.

Rebuild mirror. Choose this option if you suspect any data loss, or if attempts to clear the out-of-sync condition fail. Rebuilding the mirror copies data from the primary partition to its mirrors to recreate the volume.

To rebuild a mirrored volume:
• Select the mirrored volume in the SoftRAID window.
• Select **Rebuild** from the **Volume** menu.
• Select the desired **I/O Rate** and **I/O Size** and click **Rebuild**.

The rebuilding process will continue in the background. The settings for **I/O Rate** and **I/O Size** will determine the degree of slowdown the user will experience in other applications. SoftRAID does not need to remain open once the rebuilding process has begun. In fact, the computer may even be turned off—the rebuilding process will continue where it left off when the computer is restarted.

Failed mirror

SoftRAID will report that a mirrored voume has failed when it cannot access data from one of its constituent partitions. As long as one drive is continuing to work properly, the data in the mirrored volume will still be accessible to the user with no loss of information. A mirrored volume may fail as a result of one of two problems: corruption on one of the disks or a failed disk. Use the following steps to correct the problem:
• Make sure all disks used for the mirrored volume are registering on the SCSI bus. If a drive does not appear in SoftRAID, reseat the cables to the drive and reset CUDA. Replace the drive if it still does not appear on the SCSI chain.
• If the drive does appear on the SCSI bus, run Disk First Aid on the striped volume.
• Update the disk driver with SoftRAID.
• Reformat the disk if updating the driver and using Disk First Aid cannot resolve the problem.
• Replace the hard drive if problems persist after the drive has been reformatted.
• Rebuild the mirror after all drives in the mirrored volume are functioning properly.

I have completed the Storage Devices module.

I understand the module objectives:

- Hardware Setup
  - Types of Storage Devices
  - Busses - SCSI & EIDE (IDE)
  - Configuration
    - Floppy disk drive
    - Hard disk drive
    - Iomega Jaz and Zip drives
    - CD-ROM drives
    - Adaptec PCI cards
- Software Tools
  - Hard disk ToolKit
    - Updating driver
    - Formatting and Partitioning
  - Apple Drive Setup
  - Iomega Tools
  - Disk First Aid
  - CD-ROM ToolKit
  - PowerDomain Control Panel
- RAID systems
  - Conley SoftRAID software
- Storage Device Troubleshooting

Student _____ Teacher _____

Date _____

Power Computing Corporation

New Product SCSI Device Configuration Document

Document Control Number
NPS-3004002-01

SCSI ID and Termination Settings

Change History:

NPS-3004002-00

4/23/97	K.O'Mahoney	First assignment of official document control number.. Added Cover page, and change history. This is one of a long series of documents. The first was created by George Puckett and was further modified by Paul Wolf and Kevin O'Mahoney. This version is to add the PowerCenterPro new devices, namely the Toshiba XM-5701B 12x CD, TEAC CD-516S 16x CD, IBM Capricorn DCAS-34330 & DCAS-34330 , Segate Medalist Pro 2160.

NPS-3004002-01

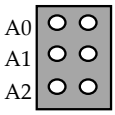
4/23/97	K.O'Mahoney	Updates from PVT testing.. PowerCenterPro Main Drive Settings changed Termination text from off to on. Added PowerCenterPro Main Drive Settings for Seagate Barracuda 4LP drives. Removed short rom TEAC 16x CD terminatior jumper .

SCSI ID and Termination Settings

Summary Page

SCSI ID and Termination Settings for Systems with terminated CD-ROM drives

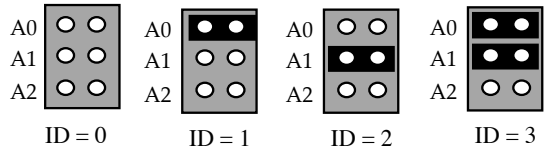
Calculating a SCSI ID

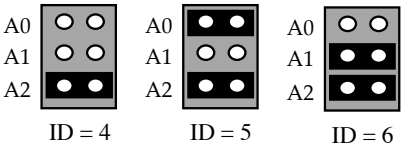


First set of pins has a value of 1
Second set of pins has a value of 2
Third set of pins has a value of 4

The SCSI ID of a drive is calculated by adding the corresponding values of the pin sets with jumpers.

Examples:





Note:
Pin set 1 is commonly refered to as A0, ID 0, or E1.
Pin set 2 is commonly refered to as A1, ID 1, or E2.
Pin set 3 is commonly refered to as A2, ID 2, or E3.

Conventional Power Computing ID Settings

Device	SCSI ID
Main hard drive	0
Second hard drive	1
JAZ drive	2
CD-ROM drive	3
(reserved for TStation MLB)	4
Zip Drive	5
(reserved for MiddleDrive™	6
Main Logic Board	7

Conventional Device Placement

One end of the SCSI cable is connected to the motherboard. The last connector at the opposite end of the cable must always be connected to the terminated SCSI device.

If there are two hard drives specified in a unit's configuration, the higher capacity drive should be set to ID 0, the other drive should be set to ID 1. Since the CD-ROM is terminated, neither hard drive should be terminated.

Notes on RAID Systems

RAID systems have two SCSI buses; one is the standard motherboard bus and the other is provided by the RAID SCSI controller card. The RAID drives are always connected to the RAID SCSI bus while any other devices such as the CD/ROM, Jaz, Zip or additional hard drives are connected to the internal SCSI bus.

For the internal SCSI bus devices, the rules above for conventional drive placement still apply. For the RAID SCSI bus, drive 0 should always be terminated and drive 1 should not be terminated.

* NOTE: On following pages, the Default setting listed is the way the drive comes out of the box from the drive vendor.

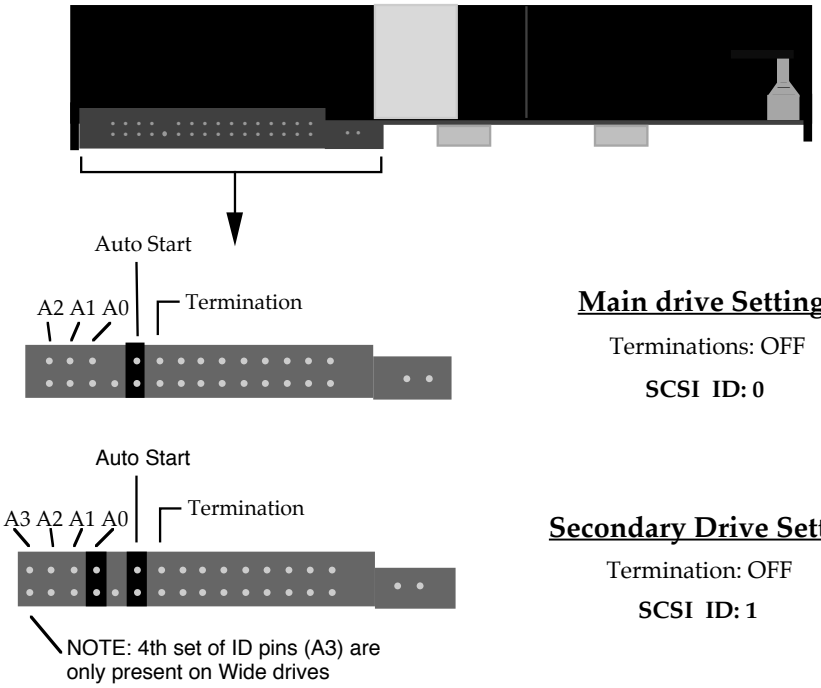
SCSI ID and Termination Settings

IBM DFHS-S2F (2 GB narrow)

IBM DFHS-S4F (4 GB narrow)

IBM DFHS-S2W (2 GB wide)

IBM DFHS-S4W (4 GB wide)



Main drive Settings

Terminations: OFF

SCSI ID: 0

Secondary Drive Settings

Termination: OFF

SCSI ID: 1

SCSI ID and Termination Settings

IBM DORS-32160 (2 GB narrow)

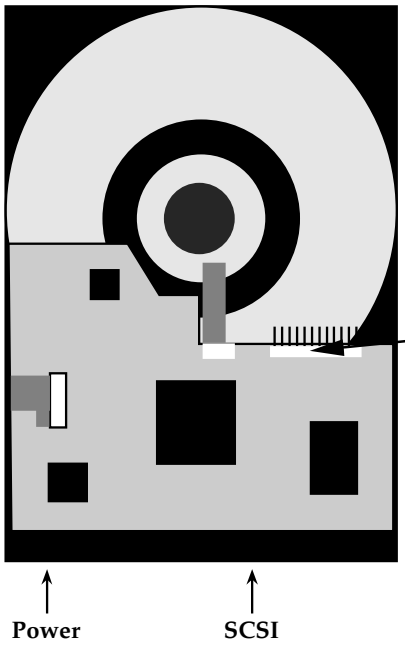
This is not to be used as an A/V Hard Disk Drive.

IBM Capricorn DCAS-32160 (2 GB narrow)

5400 RPM Ultra SCSI

IBM Capricorn DCAS-34330 (4 GB narrow)

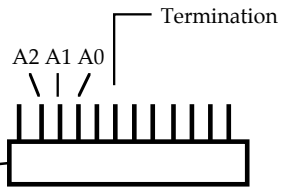
5400 RPM Ultra SCSI



Non-PowerCenter Pro

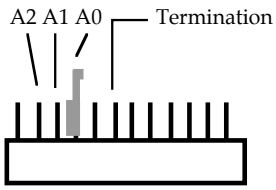
Main Drive Settings

SCSI ID: 0
Termination: OFF



Secondary Drive Settings

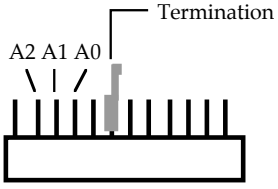
SCSI ID: 1
Termination: OFF



PowerCenter Pro

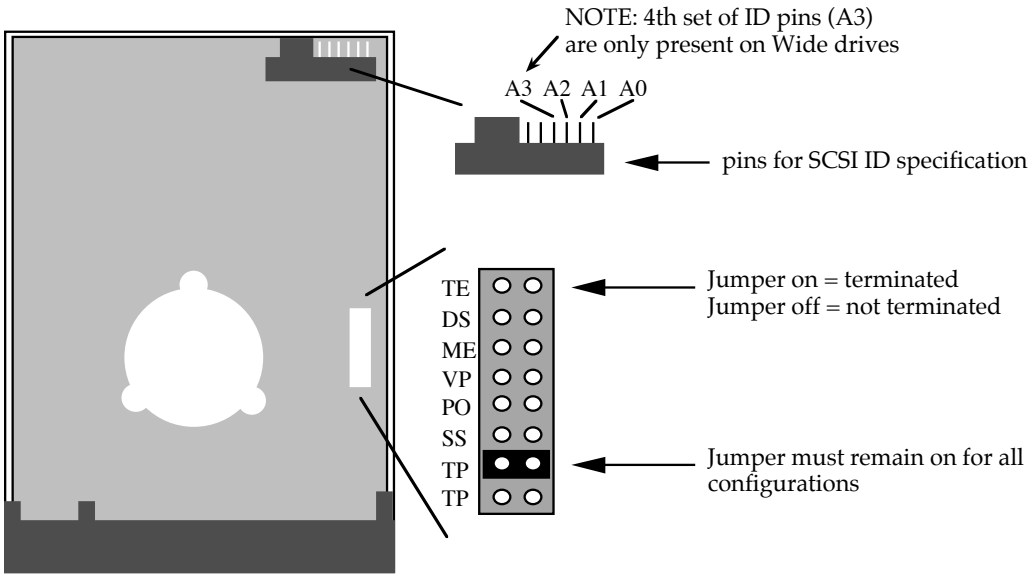
Main Drive Settings

SCSI ID: 0
Termination: ON



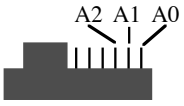
SCSI ID and Termination Settings

Seagate Hawk2XL ST31055N (1 GB)
Barracuda4LP ST32171N (2 GB)
Barracuda4LP ST34371N (4 GB)
Barracuda4LP ST34371W (4 GB, Wide)

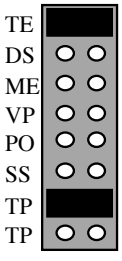


PowerCenter Pro Main Drive Settings

Termination: ON
SCSI ID: 0

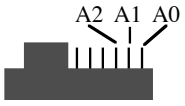


No jumpers = ID 0

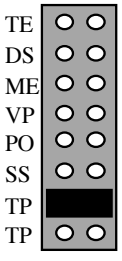


non-PowerCenter Pro Main Drive Settings

Termination: OFF
SCSI ID: 0

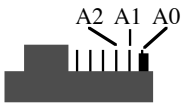


No jumpers = ID 0

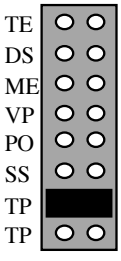


Secondary Drive Settings

Termination: OFF
SCSI ID: 1



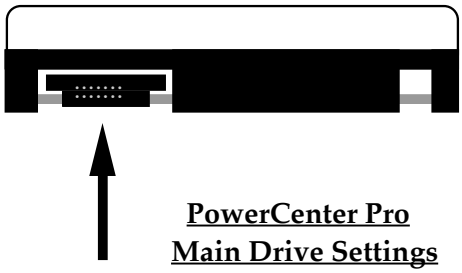
Jumper on A0 = ID 1



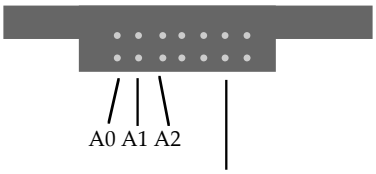
SCSI ID and Termination Settings

Seagate Medalist Pro 2160N ST52160N (2 GB narrow)

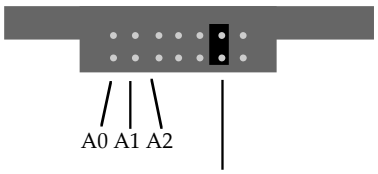
Ultra SCSI



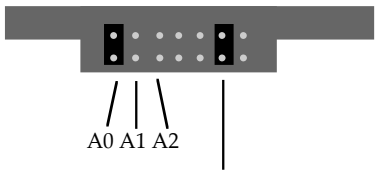
PowerCenter Pro Main Drive Settings
Termination: ON
SCSI ID: 0



Non-PowerCenter Pro Main Drive Settings
Termination: OFF
SCSI ID: 0



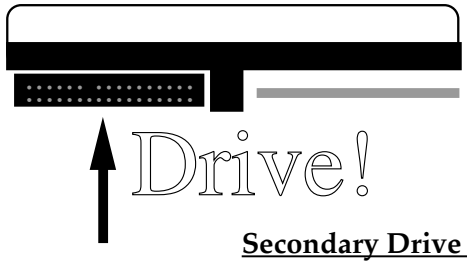
Secondary Drive Settings
Termination: OFF
SCSI ID: 1



Do Not Use This Drive!

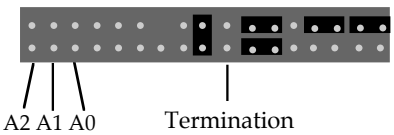
Seagate Medalist (1 GB)

Note: The termination setting on this drive is opposite that of the Quantums. It is a termination disable setting. Therefore, no jumper = termination on, while jumper means termination off.

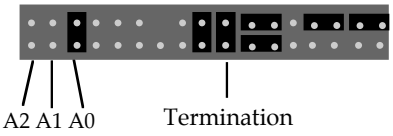


Disqualified Drive!

Main Drive Settings
Termination: ON
SCSI ID: 0



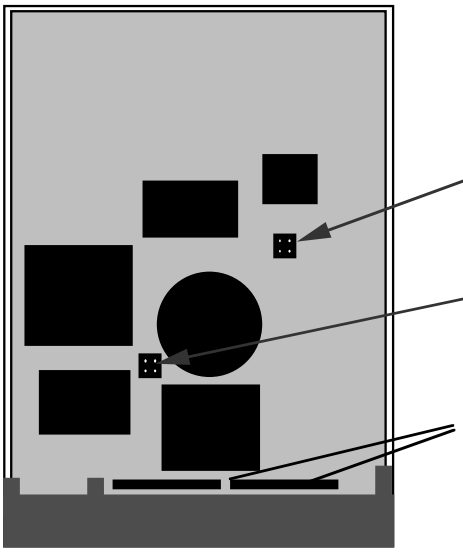
Secondary Drive Settings
Termination: OFF
SCSI ID: 1



Do Not Use This Drive!

SCSI ID and Termination Settings

Micropolis 2 GB AV



Main Drive Settings

Termination: OFF
SCSI ID: 0

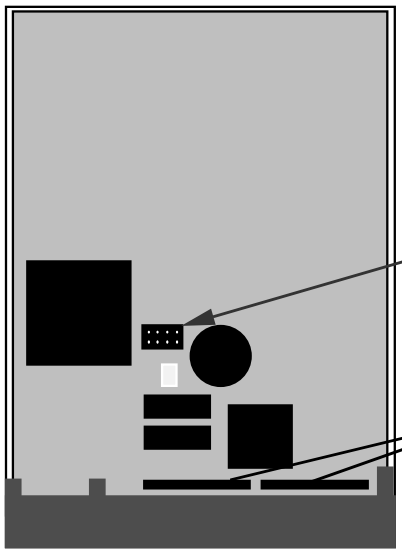
Terminating resisters
removed from drive

Secondary Drive Settings

Termination: OFF
SCSI ID: 1

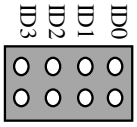
Terminating resisters
removed from drive.

Micropolis 4 GB AV



Main Drive Settings

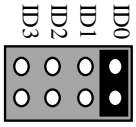
Termination: OFF
SCSI ID: 0



Terminating resisters
removed from drive

Secondary Drive Settings

Termination: OFF
SCSI ID: 1

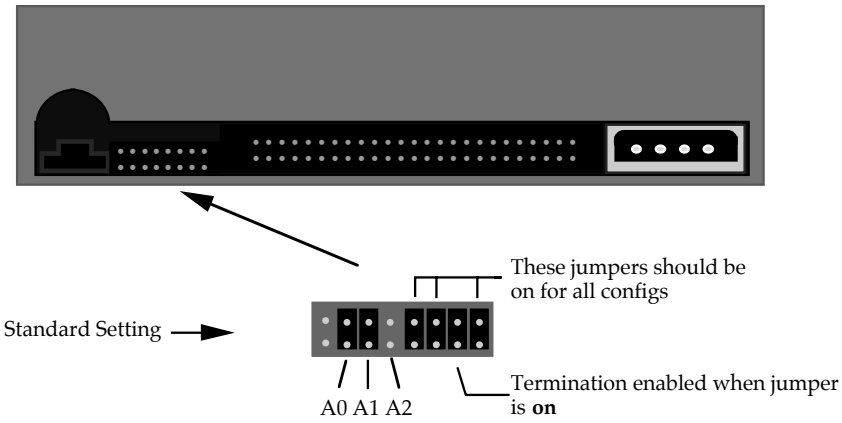


Terminating resisters
removed from drive.

SCSI ID and Termination Settings

Philips PCA80SC *(8x speed)*

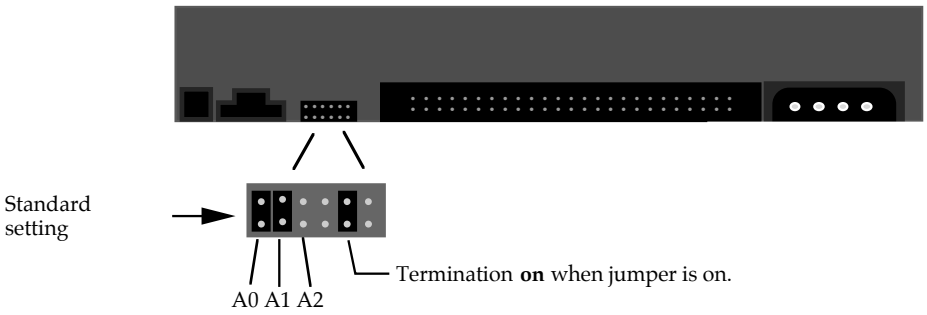
The Philips CD-ROM drive should be terminated and have a SCSI ID setting of 3



SCSI ID and Termination Settings

NEC CDR-1410A *(8x speed)*

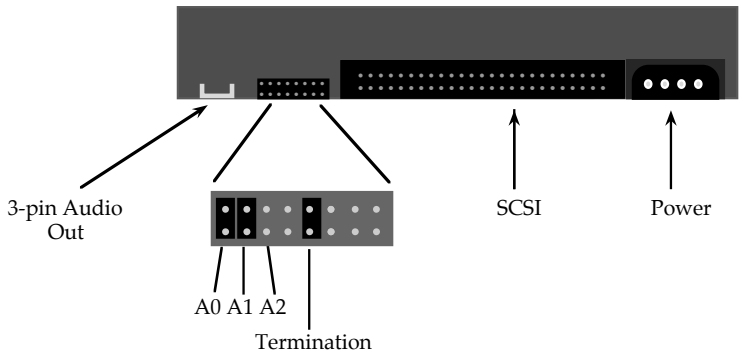
The NEC CD-ROM drive should be terminated and have a SCSI ID setting of 3.



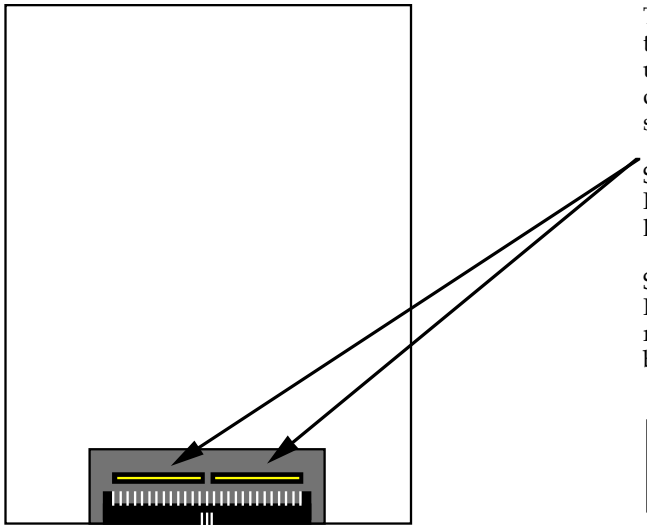
SCSI ID and Termination Settings

Toshiba XM-5701B *(12x speed)*

This Toshiba CD-ROM drive should have
termination turned on and a SCSI ID setting of 3



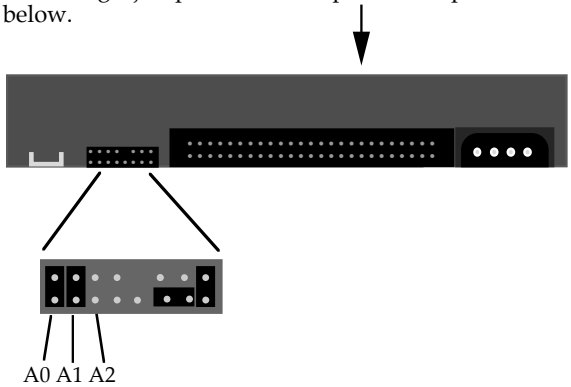
Toshiba XM-5301B / XM-5401B *(4x speed)*



The Toshiba CD-ROM drive should have termination turned off and a SCSI ID setting of 3 unless this is the only SCSI drive in the configuration. If this is the only SCSI drive skip step 1.

Step 1:
Remove the two terminating resisters which are located just behind the SCSI connector.

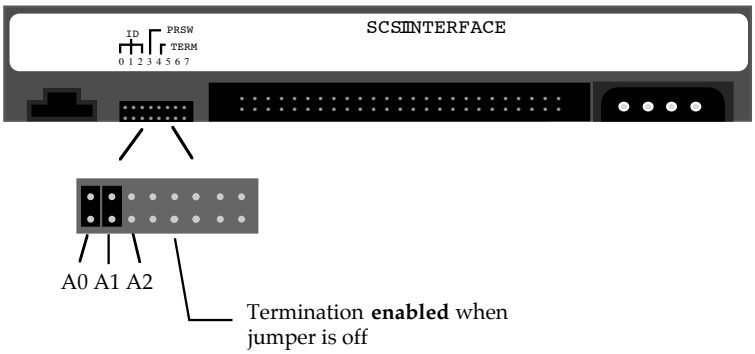
Step 2:
Position the left 2 jumpers for SCSI ID 3 leaving remaining 2 jumpers in default position as pictured below.



SCSI ID and Termination Settings

TEAC CD-516S *(16x speed)*

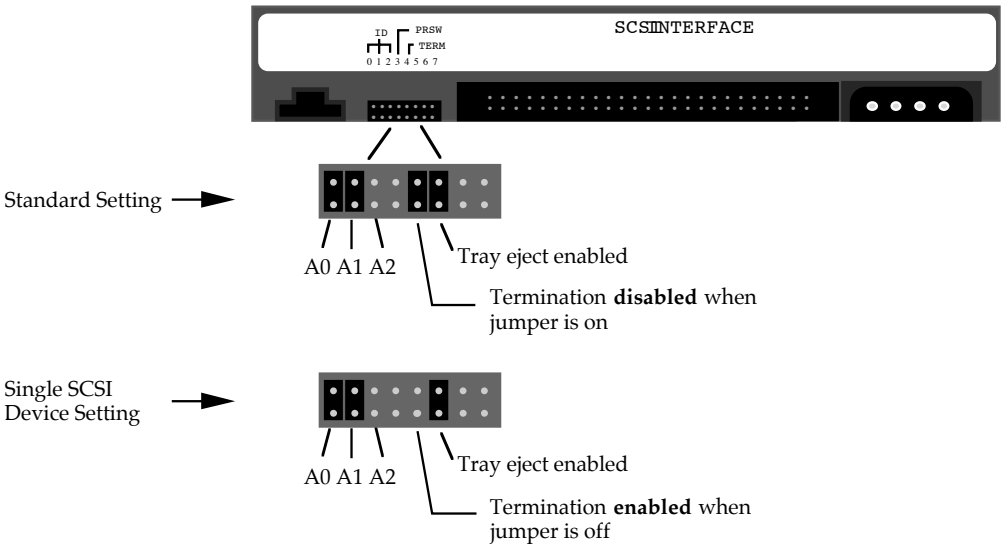
This TEAC CD-ROM drive should have termination turned on and a SCSI ID setting of 3



TEAC CD-56S *(6x speed)*

The TEAC CD-ROM drive should have termination turned off and a SCSI ID setting of 3 unless it is the only SCSI drive in the configuration. This is the default setup in which the drive is shipped by the manufacturer.

If this is the only SCSI drive in the configuration, remove the termination jumper to turn termination on.

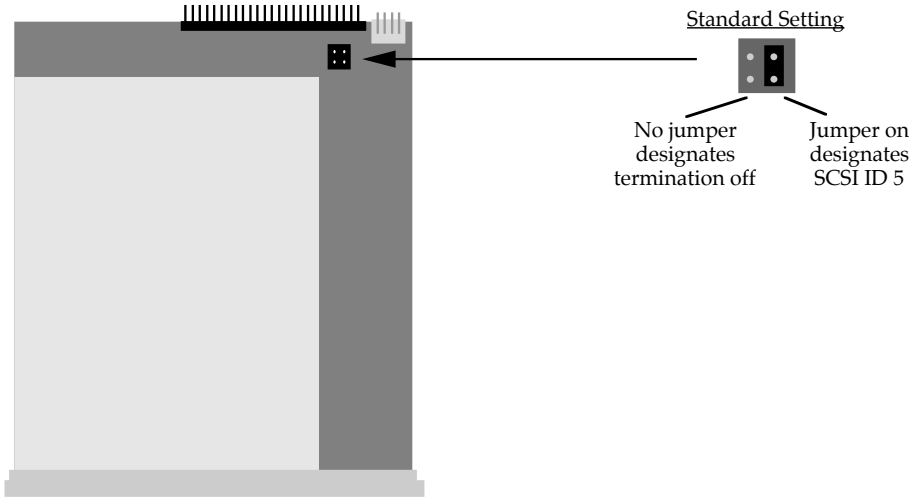


SCSI ID and Termination Settings

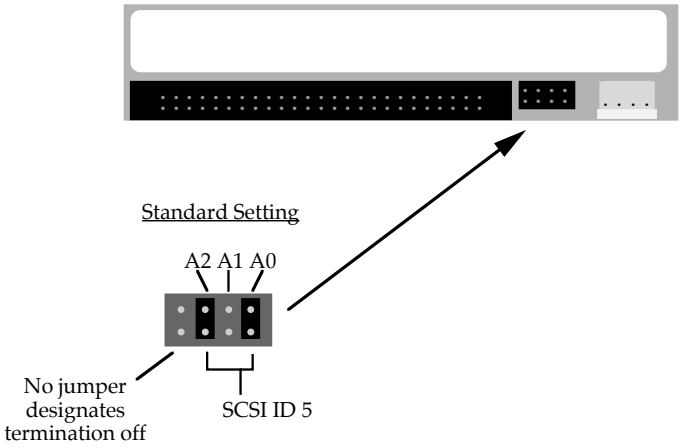
Iomega Zip

The Zip drive should have termination turned off and a SCSI ID setting of 5.

5-1/4 inch model

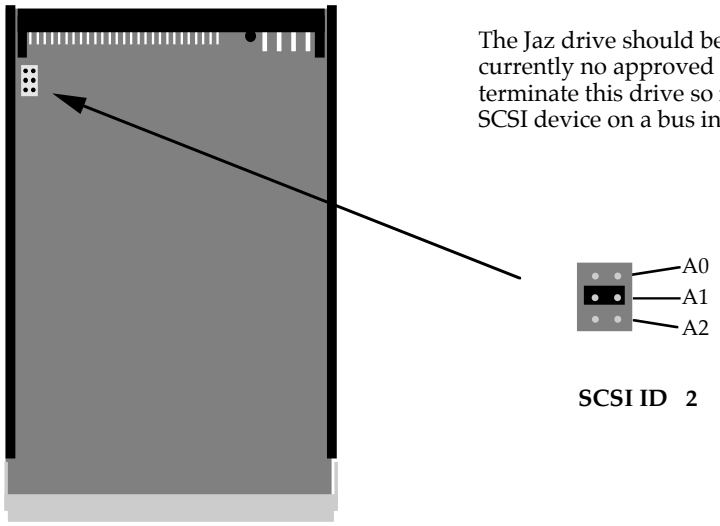


3-1/2 inch model



SCSI ID and Termination Settings

Iomega Jaz



The Jaz drive should be set to ID 2. There is currently no approved manner in which to terminate this drive so it may not be as the only SCSI device on a bus in any configuration.

SCSI ID 2